فیزیا

بۆ پۆلی پێنجەمی زانستی

ژمارەی سپاردن (٣٧٣) ساڵی ٢٠٠٢
تیراژ ١٠٠٠ دانە

٢٠٠٢ ز ٢٧٠٢ کوردی ٦٧٥٢ أ

چاپخانەی وەزارەتی پەروەردە - هەولێر

سەرپەرشتیارانی چاپ

اندریوس یوخنا کورکیس نادر موشي مراد

ܦܘܪܫܐ ܝܠܗ ܡܢ ܝܘܠܦܢ̈ܐ ܝܩܝܪ̈ܐ ܕܐܚܠܝ ܥܠ ܟܬܝܒܘܬܐ ܥܬܝܩܬܐ ܡܠܘܐܝܐ.
ܘܝܩܝܪ̈ܐ ܘܡܠܝܬܐ ܒܟܬܒܐ. ܘܕܢܐ ܝܘܠܦܢܐ ܒܕܢܢ̈ܐ ܡܕܪܫܐ ܒܟܬܒܐ ܘܚܘܕܪܐ.
ܘܒܟܬ̈ܐ ܡܢ ܡܠܦܢܘܬܐ ܕܐܘܐ ܝܘܠܦܢ̈ܐ ܡܢ ܡܟܫܠܐ ܕܡܥܕܪܢܘܬܐ ܝܠܗ ܝܘܒܠܬܐ
ܕܡܥܕܪܢܘܬܐ ܐܝܟ ܠܠܘܦܐ ܡܢ ܕܡܝܬܝܠܗ ܥܠ ܦܪܫܬܐ ܕܟܬܝܒܘܬܐ ܚܢܝܐ
ܘܡܢܬܗ ܕܟܝܒܘܬܐ ܕܣܘܪܬܐ ܘܡܢܕܝܬܗ ܥܠ ܒܟܬܒܐ ܝܘܠܦܢ̈ܐ ܕܐܝܟ ܦܠܛܐ
ܒܠܠܬܐ. ܘܡܢܝ ܒܬܐܘܪܝܐ. ܘܥܒܕ ܥܠ ܦܪܫܬܐ ܘܦܘܠܛܐ.

ܠܦܘܡ ܐܢܐ ܝܒܢܐ ܘܠܫܡܬܐ ܥܡ ܡܢ ܕܡܦܠܛܐ ܗܘܝ ܥܠܗ ܠܚܢܬܐ ܕܒܪ̈ܢܫܐ
ܡܘܢܐ ܒܝܘܠܦܢ̈ܐ ܘܝܕܥܬܐ ܒܘܟܪ̈ܐ ܕܟܝܢܝܘܬܐ ܘܡܥܕܪܢܘܬܐ. ܡܘܡܕܒܠ ܡܢܐ
ܕܡܫܐܠ ܡܢ ܒܗܘܐ ܕܐܬܝ ܒܬܪ̈ܐ ܕܦܘܪܫܐ ܚܕܬܐ ܘܡܢܝܢ ܐܘܐ ܒܬܪ̈ܐ ܕܫܒܪܐ
ܫܡܥ̈ܐ ܝܘܠܦܢ̈ܐ ܕܚܙܝ ܥܠ ܒܫܪܐ ܦܫܘܛܐ. ܫܡܥ̈ܐ ܦܫܘܛܐ ܡܕܡܝܐ ܕܪܒܝ
ܘܡܢܐ ܘܡܠܘܠܘܬܐ ܘܡܢܘܢ̈ܐ ܕܒܘܗܝ. ܠܗ ܚܠܠܐ ܘܙܘܡܢܐ ܘܒܘܒܠܐ ܘܡܫܘܚܬܐ
ܘܬܘܡܦܐ. ܘܫܡܥ̈ܐ ܦܫܘܛܐ ܐܚܪ̈ܢܐ ܕܪܒܝ ܒܘܪܒܘܬܐ ܘܡܦܠܛܘܬܐ ܘܐܚܪܬܐ
ܝܘܠܦ ܒܟܒ̈ܐ ܘܒܕܝܢܘܬܐ ܕܒܪܝܬܐ.

ܡܘܕܝܢ ܠܒܪܘܢܐ ܕܡܥܕܪܢܘܬܗ ܡܢܝ ܐܘܪܚܐ ܘܠܒܠܫܝ ܕܒܪ̈ܢܫܐ ܝܠܗ ܡܢܐ
ܠܠܫܢܐ ܕܡܫܘܚܬܗ ܦܬܝܐ ܘܐܠܦܐ ܘܡܕܪܫܬܐ ܡܢܗ ܒܝܘܠܦܢ̈ܐ ܘܝܕܥܬܐ.

ܦܣܘܩܐ ܩܕܡܝܐ

ܡܢܝܢܘܬܐ ܡܫܠܡܐ ܘܡܢܝܢܘܬܐ ܙܘܥܝܐ

Scalar Quantities And Vector Quantities

ܐ̱ܢܫܐ ܕܐܘܪܐ ܦܣܘܩܐ ܢܠܦܘܢ ܦܪܝܫܘܬܐ ܒܝܢ ܗܪܝ ܐܪܒܥܐ ܡܢ ܡܫܘܚܬܐ ܦܫܝܛܐ ܢܠܦܘܢ ܡܫܠܡܬܐ ܘܙܘܥܝܬܐ. ܘܢܝܕܥܬܐ ܕܡܘܟܪܟܘܬܐ ܡܢܘܬܐ ܕܢܠܦܢܐ ܒܡܫܘܚܬܐ ܙܘܥܝܬܐ (ܟܘܢܫܐ ܘܟܘܦܦܐ ܕܡܫܚܠܦܢܐ). ܐܝܢܘܬܐ ܕܦܪܝܫܬܐ ܘܪܟܒܬܐ ܕܡܫܚܠܦܢܐ.

(١ — ١) ܟܡܝܘܬܐ ܡܢܝܢܝܐ Scalar Quantities

ܐܝܬ ܟܡܐ ܟܡܝܘܬ̈ܐ ܦܝܙܝܩܝ̈ܐ ܘܠܐ ܦܝܙܝܩܝ̈ܐ ܩܐܝܢ ܡܫܘܚܐ ܘܡܬܡܫܚܐ ܒܡܫܘܚܬܐ
ܡܢܝܢܝܬܐ ܡܢܝܢܐ (ܗܢܐ ܗܘ ܟܡܝܘܬܗ) ܥܡ ܡܫܘܚܬܐ ܕܫܘܝܘܬܐ ܕܡܬܚܫܒܐ ܒܗ
ܐܘ ܩܐܝܢ ܒܠܐ ܟܝܗ. ܐܝܟ ܕܐܡܪܝܢ ܐܡܫܘܚܬܐ ܕܥܠܬܐ ܕܩܘܪܐ ٦٠ ܡܝܛܪܐ ܡܪܒܥܐ
ܘܬܩܠܬܐ ܕܓܘܫܡܐ ٤٠ ܟܝܠܘܓܪܡܐ ܠܟܠ ܚܕܐ ܘܚܝܘܬܐ ܕܙܝܒܩ
١٣٦٠٠ ܟܓܡ\ ܡܝܛܪܐ^{3} ܘܚܕܟܝܠ. ܐܝܟ ܡܢܝܢܐ ܕܠܘܦ̈ܐ ܕܗܝܕܪܐ ܡܢ ܗܝܕܪܐ
ܕܡܬܕܪܟܐ ܐܘ ܐܣܩܘܬܐ (ܫܘܚܪܐ ܕܡܫܘܚܬܐ) ܕܡܫܟܚܐ ܠܗ ܓܘܫܡܐ ܟܕ ܡܬܓܪܓ
ܘܚܕܐ ܡܢ ܡܕܝܢܬܐ ܠܚܕܬܐ. ܐܝܟ ܕܐܝܬ ܟܘܡܢܝܐ ܘܗܕܐ ܕܡܬܠܝܗ ܩܐܝܢ ܡܫܝܐ
ܒܟܡܝܘܬܐ ܡܢܝܢܝܐ.

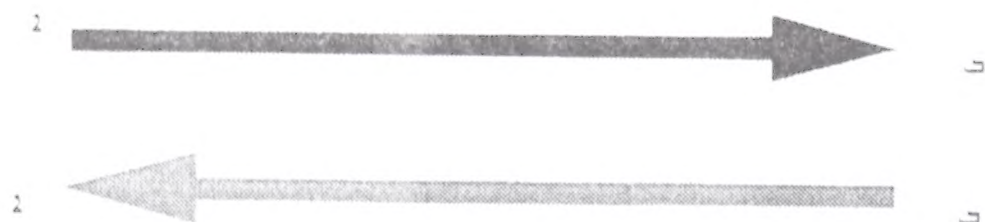
ܬܠܬ ܟܡܝܘܬܐ ܡܢܝܢܝܐ ܠܡܬܚܫܒܢܘܬܐ ܫܘܒܩܢܐ ܘܡܘܠܝܐ ܚܕܪܝܐ. ܐܢ
ܐܣܠܗ ܠܘܦܐ ܡܢ ܢܘܩܙܐ (ܐ) ܠܢܘܩܙܐ (ܒ) ܐܣܩܘܬܐ ܡܢܝܢܝܬܐ (٥٠) ܡܝܛܪܐ
ܒܬܪ ܡܢ ܢܘܩܙܐ (ܒ) ܠܢܘܩܙܐ (ܓ) ܐܣܩܘܬܐ ܐܚܪܬܐ ܡܢܝܢܝܬܐ (٧٠) ܡܝܛܪܐ
ܘܗܘܝܐ ܐܣܩܘܬܐ ܟܠܢܝܬܐ ܕܡܫܟܚܐ ܠܗ ܠܘܦܐ ܥܘܕܐ ܠܡܘܢܝܐ ܕܗܕܘܝܗ
ܐܣܩܘܬܐ ܥܡ ܚܕܕܐ ܗܢܐ ܗܘ (١٢٠) ܡܝܛܪܐ ܐܝܟ ܕܒܨܘܪܬܐ (١ . ١).

ܓ
٧٠ ܡܝܛܪܐ
٥٠ ܡܝܛܪܐ
ܐ
ܒ

ܨܘܪܬܐ (١ — ١)

(١ — ٢) ܟܡܝܘܬܐ ܙܘܥܝܐ Vector Quantities

ܠܟܠ ܡܫܟܚܐ ܕܡܚܘܐ ܗܕܐ ܙܘܥܐ ܗܦܟܐ ܐܘ ܣܝܒܠ ܡܫܟܚܐ ܕܡܚܘܐ (ܐ ܒ)
ܒܙܘܥܐ ܕܡܬܕܚܠ ܗܘ ܠܘܦܐ ܗܦܟܐ. ܡܫܟܚܐ ܕܡܚܘܐ (ܒ ܐ) ܒܙܘܥܐ ܕܡܬܕܒܪܢܐ
ܗܘܐ ܠܠܘ ܐܘ. ܒܘܐܠܗ ܒܘܢܝܘܗ ܡܢܝܢܝܐ ܒܗܘ ܐ ܐ ܒ = − ܒ ܐ ܐܝܟ
ܒܨܘܪܬܐ (١ — ٢) :



ܐܣܟܡܐ (١ — ٢)

ܐܝܟ ܗܟܢ ܟܡܝܘܬܐ ܦܫܝܛܬܐ ܠܐ ܡܣܘܢܩܐ ܒܠܚܘܕ ܠܡܬܐܡܪܗ ܘܠܐ ܬܡܫܚܬܐ ܢܦܝܫܘܬܗ ܒܡܢܝܢܐ ܕܚܘܝܠܗ ܡܢܝܢܐ ܒܠܚܘܕ ܐܠܐ ܘܠܐ ܕܡܕܬܐ ܕܐܦ ܙܘܥܗ. ܐܘ ܐܡܪܠܘܢ ܡܢ ܓܘܦܐ ܘܐܠܠܐ ܡܢ ܚܘܦܐ ܕܡܪܕܝܬܐ ܡܘܫܚܬܐ ܒܡܝܠܐ (٢٠٠) ܡܝܬܪܐ ܠܐ ܗܠܝܢ ܡܚܘܝܢܬܐ ܬܚܘܝܬܐ ܕܬܘܦܣܐ ܚܕܬܐ ܕܠܐ ܕܡܕܬܐ ܕܙܘܥܐ ܕܡܫܠܡܘܢ ܒܘܠܒܘܢ. ܡܕܡ ܡܘܫܚܬܐ (ܘܗܝ ܢܘܕܥܐ ܕܡܙܘܠܐ ܬܡܝܢܐ ܒܝܬ ܬܪܝܢ ܢܩܘܙܐ) ܘܐܒܘܬܗ ܐܝܟ ܒܠܘܠܘܬܐ ܘܫܠܐ ܘܫܘܕܥܬܐ ܘܚܠܘܙܐ ܕܠܚܒܠܐ ܒܘܕܥܐ ܘܕܥܐ ܐܫܕܝܐ ܠܐ ܦܬܝ ܡܘܫܘܚ ܠܡܬܐܡܪ ܐܠܐ ܒܡܕܬܐ ܕܬܘܢܘܬܗ ܡܢܝܢܬܐ ܘܙܘܥܗ ܚܕ ܣܕܪܐ ܐܝܟ ܕܦܬܝܐ ܐܡܪܬܐ ܘܐܠܠܘܢ ܡܢ ܚܘܦܐ ܕܡܪܕܝܬܐ ܡܘܫܚܬܐ ܒܡܝܠܐ (٢٠٠) ܡܝܬܪܐ ܙܘܥ ܡܕܢܚܐ ܘܟܐܦܐ ܡܚܘܝܬܐ ܗܠܝܢ ܬܚܘܝܬܐ ܕܬܘܦܣܐ ܟܬܪ ܕܐܦܐ ܡܘܫܚܬܐ.

ܦܬܝ ܡܕܝܐ ܐܝܟ ܕܐܢܐ ܟܡܝܘܬܐ **ܒܟܡܝܘܬܐ ܪܘܒܐ** ܘܡܚܘܝܬܐ ܗܠܝܢ ܬܚܘܝܬܐ ܕܠܚܕܐ ܡܢܗ ܠܡܚܘܝܢܐ ܡܫܚܐ ܘܠܐ ܬܠܡܝ ܠܡܫܬܘܕܥܘܬܐ ܣܘܟܠܐ ܐܘ ܡܘܠܝܐ ܢܦܩܐ ܐܠܐ ܐܝܟ ܠܗ ܡܫܬܘܕܥܘܬܐ ܡܘܠܝܐ ܕܠܝܢܐ ܦܬܝ ܡܕܝܐ ܒܡܘܠܝܐ ܕܡܚܘܝܢܐ.

ܓܘܫܡܐ ܕܡܚܘܝܢܐ ܢܕܥܝܢܢ: ܦܬܝ ܕܡܚܘܐ ܠܡܚܘܝܢܐ ܒܕܡܘܬ ܠܝܠܐ ܡܢܗ ܠܐܪܐ ܘܠܗܘܪܐ ܘܦܬܝ ܕܡܚܘܐ ܠܡܚܘܝܢܐ ܕܠܘܠܘܬܐ ܡܢ ܓܘܦܐ ܒܕܡܘܬ (ܡ⃖) ܘܠܬܘܢܘܬܐ ܡܢܝܢܬܐ ܕܐܦܐ ܡܚܘܝܢܐ ܦܬܝ ܕܡܚܘܐ ܡ⃖ ܐܘ ܡ ܒܠܚܘܕ. ܘܓܘܫܡ ܡܚܘܝܢܐ ܒܐܪܟܐ ܕܗܘܐ:

١ - ܢܘܕܥܐ ܕܐܘܪܟܐ ܠܥܠܐ ܡܚܘܐ ܓܘܫܡ ܬܘܢܘܬܐ ܡܢܝܢܬܐ ܕܡܚܘܝܢܐ.

٢ - ܪܘܒܐ ܕܐܘܪܟܐ ܓܘܫܡ ܪܘܒܐ ܕܡܚܘܝܢܐ.

٣ . ܢܡܘܬܐ ܕܥܘܪܢܐ ܕܐܪܐ ܦܘܫܵܐ ܢܡܘܬܐ ܕܡܚܫܒܢܘܬܐ ܕܡܫܘܚܝ̈ܬܐ. ܐܢ ܚܕܐ ܦܘܫܵܐ ܕܣܝܪܐ ܒܘܢܝܗ (٤٠٠) ܟܝܠܘ ܒܙܘܝܬܐ (٣٧°) ܓܪܒܝܐ ܡܕܢܚܐ ܘܐܚܕܢ ܟܠ ܢܡܘܬܐ (ܐ) ܘܡܫܘܚܬܐ ܕܥܘܪܐ ܗܘܐ (١) ܗܡ ܠܟܠ (١٠٠ ܟܝܠܘ). ܐܪܐ ܕܥܘܪܗ ٤ ܗܡ ܘܒܙܘܝܬܐ ٣٧° ܓܪܒܝܐ ܡܕܢܚܐ ܦܘܫܐ ܠܣܝܪܐ ܕܥܕܪܐ ܐܝܟ ܡܚܘܝܐ ܒܨܘܪܬܐ (١ — ٣ ܐ) ܘܗܠܐ ܘܡܢܕܘܬܐ ܠܦܪܫܬܐ ܒܝܢ ܦܪܘܫ ܙܘܝܬܐ ٣٧° ܓܪܒܝܐ ܡܕܢܚܐ ܨܘܪܬܐ (١ — ٣ܐ) ܘ ٣٧° ܡܕܢܚ ܓܪܒܝܐ ܕܦܘܫ ܒܨܘܪܬܐ (١ . ٣ܒ).

ܨܘܪܬܐ (١ — ٣ ܒ)

ܨܘܪܬܐ (١ — ٣ ܐ)

(١ — ٣) ܟܘܢܫܐ ܕܡܫܘܚܝ̈ܬܐ Addition of Vectors

ܟܠ ܚܕܐ ܡܫܘܚܝܬܐ ܡܬܚܘܝܐ ܒܬܪܬܐ ܕܗܘܝ ܒܚܕ ܙܘܥܐ ܐܘ ܒܬܪܝ ܙܘܥܐ ܦܠܚܝܐ. ܒܚܕ ܕܐܗܐ ܦܝܫܝ ܫܘܟܠܝܐ ܗܘܡܐ ܐܘ ܠܠܘܩܐ، ܗܘܝ ܒܚܕ ܙܘܥܐ ܘܦܝܫܝ ܫܘܟܠܝܐ ܚܕ ܡܢ ܗܘܡܐ ܘܐܚܪܢܐ ܠܠܘܩܐ، ܗܘܝ ܒܬܪܝ ܙܘܥܐ ܦܠܚܝܐ ܨܘܪܬܐ (١ — ٤).

ܘܠܗ ܟܘܢܫܐ ܕܡܫܘܚܝܬܐ ܗܘܝܢ ܦܝܫܝ ܡܟܘܢܫܐ ܡܘܠܕܝܢ. ܐܢ ܐܚܫܒܠܗ ܦܪܘܫܐ ܒܙܘܝܬܐ ܕܡܕܢܚܐ ܡܫܘܚܬܐ ܡܫܚܠܦܢܘܬܐ (ܡܫ١) ܒܘܢܝܗ (٤ ܟܡ) ܒܝܢ ܐܢܝܠܗ ܒܬܪܐ ܙܘܥܐ ܡܫܘܚܬܐ ܡܫܚܠܦܢܘܬܐ (ܡܫ٢) ܒܘܢܝܗ (١ ܟܡ) ܒܗܘܝ ܡܫܘܚܬܐ ܡܫܚܠܦܢܘܬܐ ܟܠܢܝܬܐ ܡܫ = ܡܫ١ + ܡܫ٢

|ܡܫ| = ܡܫ = ٤ + ١ = ٥ ܟܡ ܒܙܘܝܬܐ ܕܡܕܢܚܐ.

ܐܠܐ ܐܢ ܗܘܐ ܡܫܚܠܦܢܘܬܐ ܡܫ١ ܙܘܥ ܡܕܢܚܐ ܘܚܫܒܢܠܗ ܫܘܟܠܝܐ (+) ܘܡܫܚܠܦܢܘܬܐ ܡܫ٢ ܙܘܥ ܡܥܪܒܐ ܒܗܘܝܐ ܠܠܘܩܐ (−) ܡܕܝܢ ܦܪܘܫ

ܡܘܙܢܘܬܐ ܡܫܘܚܬܐ ܘܟܘܪܟܐ ܘܦܢܝܐ ܒܗܘܢܐ ܡܘܙܢܘܬܐ ܠܟܠܗܝܢ

$\vec{ܡ} = \vec{ܡܙ}_{١} - \vec{ܡܙ}_{٢}$.

$\vec{ܡܙ} = ܡܙ = ٤ - ١ = ٣$ ܣܡ.

ܘܡܢ ܦܠܚܐ ܗܢܘܢ ܕܪܘܫܡܐ ܒܠܗ ܘܡܘܙܢܘܬܐ ܠܟܠܗܝܢ ܐܝܟ ܡܢܝܢܐ ܠܗ.

ܡܙ١

ܡܙ٢

(ܐ) ܟܘܢܫܐ ܕܡܫܚܬܐ

(ܒ) ܟܘܪܟܐ ܕܡܫܚܬܐ

ܨܘܪܬܐ (١ — ٤)

ܟܘܢܫܐ ܕܡܫܚܬܐ ܡܫܘܚܝܬܐ (ܒܐܘܪܚܐ ܕܪܘܫܡܐ) :

ܠܟܘܢܫܐ ܕܬܪܝܢ ܡܫܚܬܐ ܐܘ ܝܬܝܪ ܦܘܫܐ ܡܬܦܫܩܐ ܚܕܐ ܡܬܘܚܕܐ ܕܪܘܫܡܐ ܠܟܠܗܘܢ ܡܫܚܬܐ ܘܐܝܟ ܫܘܝܐ ܡܫܚܬܐ ܡܕܡܝܐ ܘܡܢ ܪܝܫܗ ܐܝܟ ܫܘܝܐ ܡܫܚܬܐ ܬܪܝܢܐ ܘܡܢ ܪܝܫܗ ܕܬܪܝܢܐ ܐܝܟ ܫܘܝܐ ܡܫܚܬܐ ܬܠܝܬܝܐ ܘܗܟܢܐ. ܘܡܫܚܬܐ ܫܘܝܐ ܡܢ ܫܘܪܝܐ ܕܡܫܚܬܐ ܩܕܡܝܬܐ ܕܡܫܚܬܐ ܐܚܪܝܐ ܗܘܐ ܟܘܢܫܐ ܕܟܠ ܡܫܚܬܐ ܒܡܬܠܬܐ ܘܙܘܝܬܐ ܘܐܝܟ ܡܕܡ ܡܬܠܬܐ ܦܠܚܐ ܟܡܬܠܬܐ ܕܡܫܚܬܐ. ܐܝܟ ܡܬܚܙܐ ܒܨܘܪܬܐ (١ — ٥).

ܨܘܪܬܐ (١ — ٥)

ܬܘܦܩܐ

ܗܘܝܒܕܠܗ ܡܝܢܐ ܡܢ ܚܝܠܐ ܟܠ ܬܘܪܥܐ ܐܝܟ ܡܘܚܘܝܢܐ ܒܨܘܪܬܐ (١ — ٥) ܐܪܝܟ ܦܘܠܛܝܗ ܐܝ ܗܘܘ :

ܐ- ܚ١ = ٢٠٠ ܚܘܠܝ ܒܢܘܪܐ (ܗ° ١) ܕܪܓܐ ܠܪܒܝܥ ܡܕܝܢܬܐ.

ܒ- ܚ٢ = ٢٥٠ ܚܘܠܝ ܒܢܘܪܐ (ܗ° ٢) ܕܪܓܐ ܬܠܝܬܝ ܡܕܝܢܬܐ.

ܓ- ܚ٣ = ٣٠٠ ܚܘܠܝ ܙܘܥ ܬܠܝܬܝܐ.

ܥܢܝܐ

ܚܪܝܚ ܡܥܘܚܬܐ ܕܪܘܥܬܐ ١ ܗܡ ܠܟܠ ١٠٠ ܚܘܠܝ. ܒܗܘ ܕܐܘܐ ܒܪܥܝܚ ܡܢܒܢܐ ܢܘܪܗ (٢) ܗܡ ܘܒܢܘܪܐ (ܗ° ١) ܠܪܒܝܥ ܡܕܝܢܬܐ ܘܡܢ ܥܘܠܡܗ ܪܥܝܚ ܡܢܒܢܐ ܢܘܪܗ ٢,٥ ܗܡ ܘܒܢܘܪܐ (ܗ° ٢) ܬܠܝܬܝ ܡܕܝܢܬܐ ܘܡܢ ܥܘܠܡܐ ܕܡܢܒܢܐ ܗܪܢܐ ܪܥܝܚ ܡܢܒܢܐ ܢܘܪܗ (٣) ܗܡ ܙܘܥ ܬܠܝܬܝܐ ܒܝ ܪܥܝܚ ܡܢܒܢܐ ܡܢ ܥܘܪܢܐ ܕܡܢܒܢܐ ܡܕܝܢܐ ܠܥܘܠܡܐ ܕܡܢܒܢܐ ܗܠܝܗܐ ܘܚܠܝܚ ܢܘܪܗ ܒܢܘܚܠܗ (٤,٩) ܗܡ ܘܒܢܘܪܐ (ܒ) ܬܠܝܬܝܐ ܡܕܝܢܬܐ. ܒܗܘ ܕܐܘܐ ܦܘܠܛܐ ܕܗܠܝܗܘܢ ܡܢܒܢܐ ܚܘܐ (٤٩٠) ܚܘܠܝ ܘܒܢܘܪܐ (ܗ°) ܬܠܝܬܝ ܡܕܝܢܬܐ ܐܝܟ ܡܘܚܘܝܢܐ ܒܨܘܪܬܐ (١ — ٥).

ܒܘܢܝܐ ܕܗܪܝ ܡܢܒܢܐ ܒܢܬܗܝܗ ܘܘܝܗܐ :

ܠܗܝܟܐ ܕܦܘܠܛܐ ܕܗܪܝ ܡܢܒܢܐ $\vec{ܐ}$. $\vec{ܒ}$ ܕܗܪܝܢ ܒܢܬܗܝܗ ܘܘܝܗܐ ܒܘܢܠܗ (ܗ°) ܐܝܟ ܒܨܘܪܬܐ (١ — ٦). ܦܝܫ ܪܥܝܡܐ ܡܢܒܢܐ $\vec{ܐ}$. $\vec{ܒ}$ ܡܢ ܚܕܐ ܢܘܩܘܕܬܐ ܐܝܟ (ܗ) ܘܦܝܫ ܪܥܝܡܐ ܡܗܝܚ ܐܠܟܐ ܕܐܠܟܗ ܥܒܕܐ ܝܠܝܗ ܡܢܒܢܐ $\vec{ܐ}$. $\vec{ܒ}$ ܘܡܦܠܓܐ ܕܡܗܝܚ ܐܠܟܐ $\vec{ܓ}$ ܟܒܪܢܐ ܒܢܘܩܘܕܬܐ ܕܗܦܩܬܐ ܕܡܢܒܢܐ ܠܟܦܡ ܦܘܠܛܐ ܕܐܢܐ ܗܪܝ ܡܢܒܢܐ ܘܡܥܒܚܝܚ ܒܘܢܠܗ ܡܢ ܐܚܢܘܬܐ

$$ܓ = \sqrt{ܐ^{٢} + ܒ^{٢} + ٢\,ܐ\,ܒ\,ܓܬܐ\,ܗ} \quad \ldots\ldots (١ — ١)$$

$$ܛܓ\,ܕ = \frac{ܒ\,ܓܬܐ\,ܗ}{ܒ\,ܓܬܐ\,ܗ + ܐ} \quad \ldots\ldots (١ — ٢)$$

ܨܘܪܬܐ ١ — ٦

ܡܘܦܬܐ

ܐܘܟܒܠܗ ܗܕܝ ܚܝܠܐ ܥܠ ܚܕ ܣܘܪܛܐ ܒܘܠܐ ܕܡܕܢܚܐ ٤٠٠ ܟܡ/ܫ
ܡܕܢܚܐ ܘܒܘܠܐ ܕܐܚܪܢܐ ٣٠٠ ܟܡ/ܫ. ܘܒܙܘܝܬܐ (٣٧) ܠܓܒܝ ܡܕܢܚܐ ܒܡܪܐ
ܐܝܟ ܒܘܠܐ ܘܙܘܝܬܐ ܕܦܘܠܚܢܐ. ܐܢ ܝܕܥܬ ܐܢ ܓܒ ٣٧ = ٠,٦؟

ܫܪܝܐ

ܫܩܘܠ ܦܘܠܚܢܐ ܕܪܕܘܝܐ ܚܝܠܐ ܝܠܗ ܫ ܟܡ/ܫ. ܘܙܘܝܬܐ ܕ ܠܓܒܝ
ܡܕܢܚܐ ܐܝܟ ܕܒܨܘܪܬܐ (١ — ٧) ܘܚܙܝ ܠܨܘܪܬܐ (١ — ١)

ܫ² = ٤٠٠² + ٣٠٠² + ٢ × ٤٠٠ × ٣٠٠ ܓܒ ٣٧

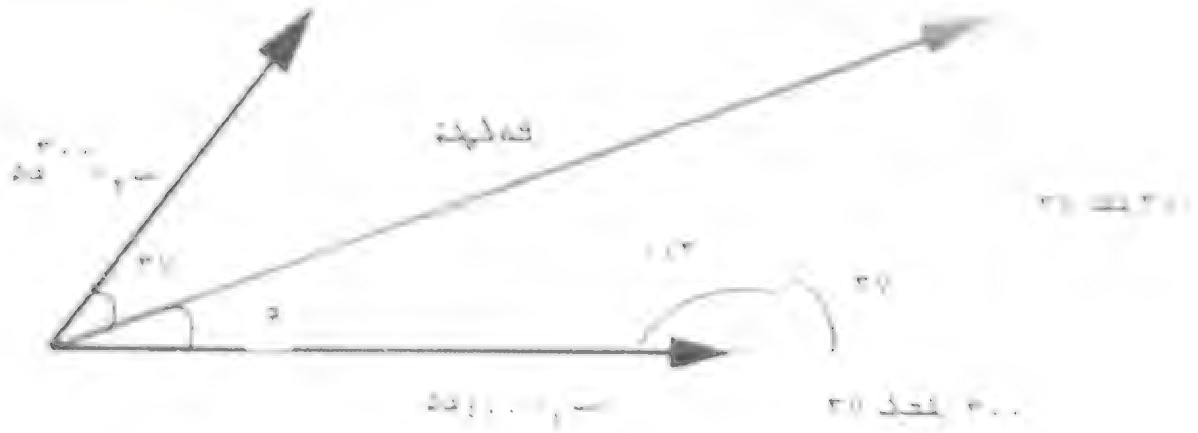
ܫ² = ١٦٠٠٠٠ + ٩٠٠٠٠ + ٢٤٠٠٠٠ × ٤/٥

ܫ = ٤٤٢٠٠٠ = ٦٦٤.٨٣ ܟܡ/ܫ.

ܘܚܙܝ ܠܨܘܪܬܐ ١ — ٢

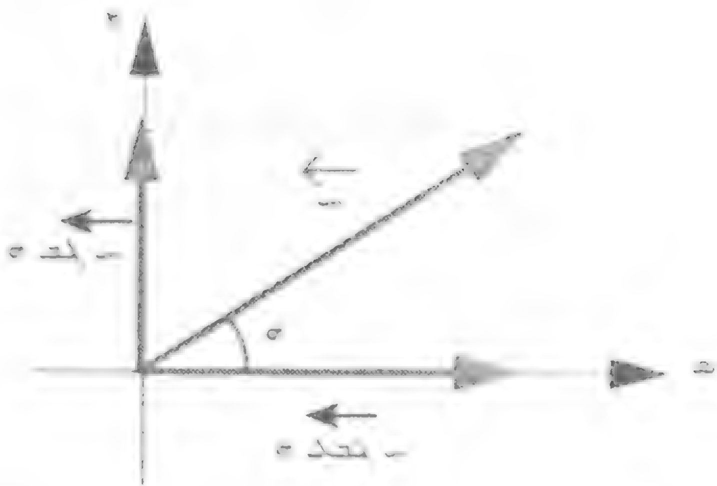
ܝܐ ܕ = (٣٠٠ ܓܒ ٣٧) / (٣٠٠ ܓܒ ٣٧ + ٤٠٠) = (٠.٦ × ٣٠٠) / (٠.٨ × ٣٠٠ + ٤٠٠)

- ٠,٢٨١٣ ܘܡܢ ܗܘܪܟܐ ܟܢܘܫ ܕ = ١٥,٧ ܠܕܪ̈ܓܐ ܡܕܝܢܬܐ



ܨܘܪܬܐ (١ — ٧)

(١ — ٤) ܥܕܫܬܐ ܕܡܥܒܪ̈ܢܐ



ܨܘܪܬܐ (١ — ٨)

ܦܫܝܛܐ ܗܠܝܢ ܥܕܫܬܐ ܕܟܠ ܡܥܒܪ̈ܢܐ ܐܝܟ ܣ ܕܐܬܐ ܘܥܒܕܐ ܥܡܗ (ܒ) ܙܘܝܬܐ ܥܡ ܡܫܘܚܬܐ ܠܐܪܐ ܡܕܒܪܐ ܘܩܒܠܐ ܚܕ ܡܢܗ ܒܝܘܩܐ ܕܡܫܘܚܬܐ ܡܫܚܬܐ ܘܟܘܢܗ (ܣ ܟܘܣ ܒ).

ܘܐܚܪܢܐ ܒܝܘܩܐ ܕܡܫܘܚܬܐ ܙܒܐ ܘܟܘܢܗ (ܣ ܓܒ ܒ).

ܐܝܟ ܡܚܘܝܢܐ ܒܨܘܪܬܐ (١ — ٨).

ܟܘܢܐ ܕܡܥܒܪ̈ܢܐ ܢܦܠܐ ܒܚܕ ܕܘܟܐ ܒܐܘܪܚܐ ܕܥܕܫܬܐ ܘܩܒܠܬܐ :

ܐ) ܗܘܦܟܠܗ ܡܥܒܪ̈ܢܐ ܕܣܠܐ ܣ١ ܣ٢ ܣ٣ ܠܠ ܚܕ ܠܗܘܬܐ ܘܡܟܒܕ ܘܥܡܗ ܡܫܚܐ ܒ . ܒܥܩܘܒܐ ܙܘܝܬܐ ܡܫܘܚܬܐ ܐܝܟ ܒܨܘܪܬܐ (١ — ٩ ܐ). ܦܫܝܛܐ ܗܠܝܢ ܡܟܘܢܐ ܕܗܘܠܟܐ ܕܐܢܐ ܚܠܐ



ܨܘܪܬܐ (١ — ٩ ܐ)

ܚ ܒܟܪ̈ܝܘܬܐ ܕܟܠ ܚܝܠܐ ܠܚܘܕܘܗܝ ܡܬܒܥܝܢ ܘܡܟܢܫܝܢ ܐܝܟ ܡܦܝܣܢܐ ܒܡܘܪܟܒܬܐ ܒܒ̈ܪܬܐ.

ܚܝܠܐ	ܚ ܣ	ܚ ܨ
ܚ١	ܚ١ ܓܬܐ ܣܦܝܡܐ	ܚ١ ܓܐ ܣܦܝܡܐ
ܚ٢	ܚ٢ ܓܬܐ ܒ	ܚ٢ ܓܐ ܒ
ܚ٣	ܚ٣ ܓܬܐ ܓ	ܚ٣ ܓܐ ܓ

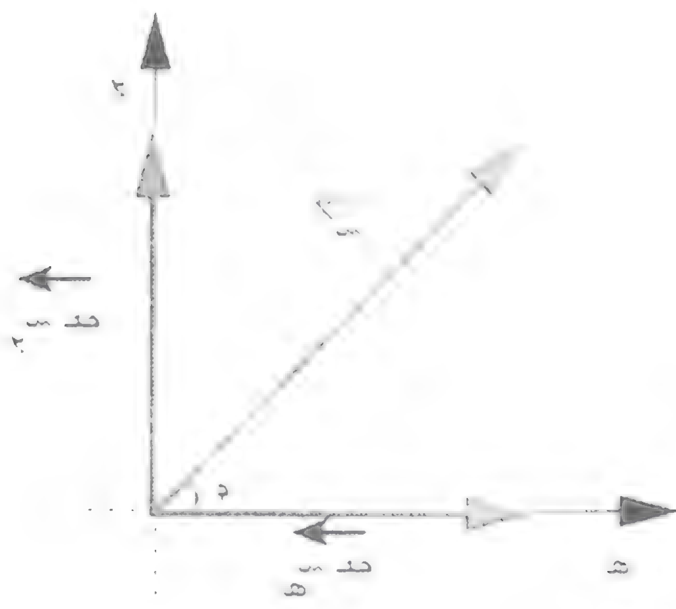
ܟܕ ܗܘܐ ܚܒ $ܚ_{ܣ}$ = ܚ١ ܓܬܐ ܣܦܝܡܐ + ܚ٢ ܓܬܐ ܒ + ܚ٣ ܓܬܐ ܓ

ܘܗܘܐ ܚܒ $ܚ_{ܨ}$ = ܚ١ ܓܐ ܣܦܝܡܐ + ܚ٢ ܓܐ ܒ + ܚ٣ ܓܐ ܓ

ܘܡܢ ܐܣܟܡܐ (١ — ٩ ܒ)

ܘܒܢܦܩܬܐ ܕܐܦܐ ܕܒܝܬ ܬܘܪܣ

ܒܗܘܐ ܦܘܠܛܐ ܚ ܫܘܐ



ܐܣܟܡܐ (١ — ٩ ܒ)

$$ܠ = \sqrt{(ܚܒ\ ܚ_{ܨ})^{2} + (ܚܒ\ ܚ_{ܣ})^{2}} \qquad (١ — ٣)$$

$$ܛܠ\ ܕ = \frac{ܚܒ\ ܚ_{ܨ}}{ܚܒ\ ܚ_{ܣ}} \qquad (١ — ٤)$$

ܦܘܫܩܐ

ܐܘܟܝܠܘ ܚܝܠܐ (٢٠٠) ܢܝܘܛ. ܡܕܢܚܐ (١٠٠√٢) ܢܝܘܛ. ܓܪܒܝܐ ٤٥ ܠܓܪܒܝ ܡܥܪܒܐ. (٥٠٠) ܢܝܘܛ. ܓܪܒܝܐ (٣٧°) ܬܝܡܢܐ ܡܥܪܒܐ ܥܠ ܚܕ ܦܘܪܫܐ ܘܐܝܟ ܚܝܠܐ ܝܗܘܐ ܢܦܠܐ ܥܠ ܚܕ ܢܘܩܐ. ܐܫܟܚ ܦܘܠܛܐ ܕܐܝܟ ܚܝܠܐ ܟܕܫܐ

ܒܝܕ ܐܫܡܫܐ ܒܣܘܪܛܐ ܕܚܝܠܐ ܐܝܟ ܕܨܘܪܬܐ (١ ـــ ١٠ ܐ) ܘܒܝܕ ܟܕܫܐ ܥܠ ܚܝܠܐ ܠܡܪܟܒܘ ܓܪܒܝܐ ܣ ܨ ܐܝܟ ܡܚܘܝܐ ܒܣܘܪܛܐ ܠܬܚܬ :

ܚܝܠܐ	ܚ ܣ	ܚ ܨ
ܚ ١ = ٢٠٠ ܢܝܘܛ	٢٠٠ ܓܬܐ ܨܦܪܐ = ٢٠٠	٢٠٠ ܓܐ ܨܦܪܐ = ܨܦܪܐ
ܚ ٢ = ١٠٠√٢ ܢܝܘܛ	−١٠٠√٢ ܓܬܐ ٤٥ = −١٠٠	+١٠٠√٢ ܓܐ ٤٥ = +١٠٠
ܚ ٣ = ٥٠٠ ܢܝܘܛ	−٥٠٠ ܓܬܐ ٣٧ = −٤٠٠	−٥٠٠ ܓܐ ٣٧ = −٣٠٠

١٠٠√٢ ܢܛ

٤٥

٣٧ ٢٠٠ ܢܛ

٥٠٠ ܢܛ

ܨܘܪܬܐ (١ ـــ ١٠ ܐ)

ܚܒ ܚ ܣ = ٢٠٠ − ١٠٠ − ٤٠٠ = − ٣٠٠ ܢܝܘܛ.

ܚܒ ܚ ܨ = ܨܦܪܐ + ١٠٠ − ٣٠٠ = − ٢٠٠ ܢܝܘܛ.

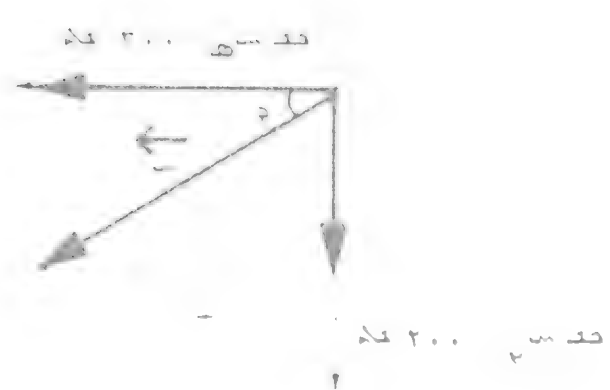
ܘܡܢ ܨܘܪܬܐ (١ ـــ ١٠ ܒ) ܡܚܘܝܢܢ ܥܠ ܚܝܠܐ ܕܦܘܠܛܐ ܚ ܘܨܘܒܥܗ ܕܝܠܗ

$$ܚ = \sqrt{(٣٠٠)^2 + (٢٠٠)^2}$$

$$ܚ = \sqrt{١٣٠٠٠٠}$$

$$ܚ = ٣٦٠.٥٥$$

$$ܛܠ\ ܕ = \frac{٢٠٠}{٣٠٠} = ٠.٦٦٦٧$$



ܡܛܘܣܐ ∢ ܕ = ٣٣,٦ ܕܪܓܐ ܡܢܕܢܐ   ܨܘܪܬܐ (١ — ١٠ ܒ)

(1 — ٥) ܣܘܓܐܐ ܕܡܘܒܠܢ̈ܐ Vectors product

ܡܕܡܠܘ ܘܟܠܐܠܘ ܡܢܟ ܡܢ ܓܘܦܐ ܟܚܢܕܐ ܠܗ ܒܘܢܝܐ ܕܡܘܒܠܢ̈ܐ ܕܗܘܝ ܐܢܐ ܡܘܒܠܢܐ ܡܢ ܚܕ ܐܕܢܐ ܘܡܘܒܠܢ̈ܐ ܕܡܘܚܝܘܬܐ ܡܢ ܓܘܦܐ ܦܝܢ ܒܢܝܐ ܟܝܢ ܡܘܒܠܢ̈ܐ ܕܡܘܚܝܘܬܐ ܘܡܘܒܠܢ̈ܐ ܕܚܝܠܐ ܦܝܢ ܒܢܝܐ ܟܝܢ ܡܘܒܠܢ̈ܐ ܕܚܝܠܐ ܒܕ ܠܐ ܗܘܐ ܒܢܝܢܐ ܕܡܒܢ̈ܝܐ ܕܡܘܚܝܘܬܐ ܟܝܢ ܡܘܒܠܢ̈ܐ ܕܚܝܠܐ ܒܗܝ ܠܝܬ ܗܘܟܢܐ ܦܘܫܐ ܠܦܠܓܐ ܕܐܗܐ ܒܘܢܝܐ. ܐܠܐ ܡܘܒܠܢܐ ܝܠܗ ܣܘܓܐܐ ܕܬܪܝܢ ܡܘܒܠܢ̈ܐ ܡܢ ܐܕܢܐ ܡܫܚܠܦܐ ܘܦܠܓܐ ܡܢ ܣܘܓܐܐ ܟܡܝܘܬܐ ܡܢ ܒܡܟܢܐ ܘܗܘܟܢܐ ܦܘܫܐ ܘܗܘܟܢܐ ܕܐܢܐ ܟܡܝܘܬܐ ܘܡܘܒܠܢܘܬܐ ܐܟܠܝ ܟܠ ܐܕܢܐ ܕܣܘܓܐܐ ܠܐܢܐ ܡܘܒܠܢ̈ܐ ܘܐܝܟ ܐܡܪ ܐܕܝ ܐܕܢܐ ܡܢ ܣܘܓܐܐ ܕܡܘܒܠܢ̈ܐ ܝܠܗ:

2 ـ ܣܘܓܐܐ ܟܡܝܢܐ ܐܘ ܡܢܝܢܐ ܕܡܘܒܠܢ̈ܐ Scalar products

ܦܝܢ ܡܕܝܢ ܐܗܐ ܣܘܓܐܐ ܫܕܡܐ ܠܗܘܬܐ ܒܣܘܓܐܐ ܒܡܝܢܐ ܘܐ. ܦܝܢܠܘ ܓܠܝܬܐ ܣܘܓܐܐ ܕܐܕܝ ܡܘܒܠܢ̈ܐ $\vec{ܐ}$ ܘ $\vec{ܒ}$ ܣܘܓܐܐ ܟܡܝܢܐ ܦܝܢ ܟܐܒܢܐ ܐܝܟ ܕܐܬܐ $\vec{ܐ}$. $\vec{ܒ}$ ܘܗܘܐ ܦܠܓܐ ܕܣܘܓܐܐ ܠܐ ܒܘܢܐ ܠܦܠܓܐ ܕܣܘܓܐܐ ܕܟܡܝܘܬܐ ܕܐܕܘܝܗ ܡܘܒܠܢ̈ܐ ܒܓܒܐ ܠܡܢܕܐ ܕܙܘܝܬܐ ܫܒܝܩܬܐ ܒܝܢܬܝܗ (ܗ) ܗܢܐ ܘܕܝܢ:

$$ܠ = \vec{ܐ} . \vec{ܒ} = ܐ\ ܒ\ ܓܬܒ\ ܗ \quad \text{......} \quad (١ — ٥)$$

ܘܗܢܐ ܚܘܝܐ ܕܦܠܓܐ ܕܣܘܓܐܐ ܕܗܐ ܠܝܬܠܘ ܪܘܫܐ ܘܠܝܬܠܘ ܟܡܝܢܐ ܡܢܝܢܐ ܘܡܘܒܠܢܐ ܦܠܓܐ ܡܢ ܣܘܓܐܐ ܕܚܝܠܐ ܒܡܘܚܝܘܬܐ ܣܘܓܐܐ ܡܢܝܢܐ ܒܐܗܐ ܟܡܝܘܬܐ ܡܢܝܢܝܬܐ ܠܐ ܝܠܗ ܪܘܫܐ. ܘܐܝ ܗܘܟܝܕܠܗ ܚܝܠܐ ($\vec{ܚ}$) ܒܟܠ ܚܕ

ܠܘܩܒܠ ܘܦܟܠܝܠܗ ܡܫܬܢܝܢܘܬܐ ܒܡܠܘܗ (ܡܫ) ܐܘܪܚܐ ܘܨܝܕܐ ܒܡܠܘܗ (ܗ) ܥܡ ܕܐܗܐ ܚܝܠܐ ܟܕ ܗܘܐ ܥܒܕܐ (ܥܒ) ܚܫܝܒܐ ܟܝܢ ܐܗܐ ܚܝܠܐ

ܥܒ = ܚܝ⃖ . ܡܫ⃖ = ܚ ܘ ܓܬܒ ܗ

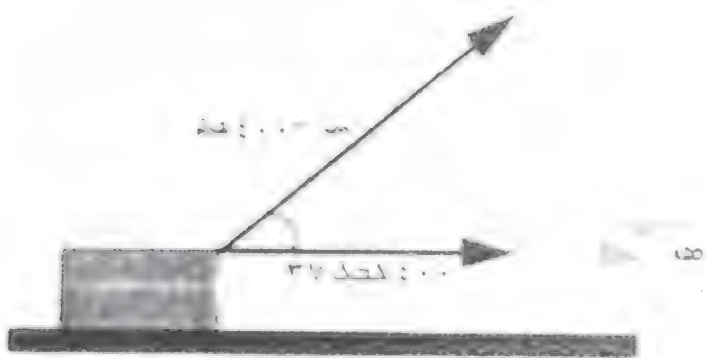
ܘܟܕ ܡܫ ܓܬܒ ܗ = ܡܢܬܐ ܕܡܫܬܢܝܢܘܬܐ ܥܠ ܡܫܬܢܝܢܘܬܐ ܕܚܝܠܐ ܟܡܘ ܕܐܗܐ ܥܒܕܐ ܡܦܠܚܐ ܗܘܐ ܦܠܛܐ ܕܡܫܘܚܬܐ ܕܚܝܠܐ × ܡܫܟܚܬܐ ܕܡܫܬܢܝܢܘܬܐ ܒܝܘܪܚܐ ܕܐܗܐ ܚܝܠܐ.

ܡܬܠܐ ١ :

ܗܘܟܒܠܗ ܚܝܠܐ ܒܡܠܘܗ (٤٠٠) ܢܝܘܛ. ܥܠ ܠܘܩܒܠ ܡܫܕܐ ܥܠ ܬܦܢܝܬܐ ܐܦܩܝܬܐ ܘܐܗܐ ܚܝܠܐ ܐܝܟ ܗܘܐ ܘܨܝܕܐ ܒܡܠܘܗ (٣٧°) ܥܡ ܬܦܢܝܬܐ. ܚܫܘܒ ܒܡܠܘܗ ܕܥܒܕܐ ܠܡܫܕܐ ܕܠܘܩܒܠ ܡܫܬܢܝܢܘܬܐ ܒܡܠܘܗ (٣) ܡܛܪܐ ܥܠ ܕܐܗܐ ܬܦܢܝܬܐ

ܦܘܫܩܐ :

ܡܢ ܨܘܪܬܐ (١ ــ ١١)



ܨܘܪܬܐ (١ ــ ١١)

ܥܒ = ܚܝ⃖ . ܡܫ⃖

ܥܒ = ܚ ܡܫ ܓܬܒ ܗ

$$= ٤٠٠ \times ٣ \times \frac{٤}{٥} \text{ ܢܝܘܛ . ܡܛܪܐ}$$

= ٩٦٠ ܓܘܠ

ܡܬܠܐ ٢:

ܠܘܩܒܠ ܝܘܩܪܗ (٢٠) ܢܝܘܛ. ܡܫܕܐ ܥܠ ܦܐܬܐ ܕܐܪܥܐ ܕܟܠܘܦܐ ܗܘ. ܘܡܟܠܠܗ ܟܠܘܦܐ ܐܝܟ ܡܫܬܢܝܢܘܬܐ ܐܘܩܝܬܐ ܒܡܠܘܗ (٠.٣) ܡܛܪܐ. ܚܫܒ ܟܠܗ ܒܡܠܘܗ ܕܥܒܕܐ ܕܟܒܠܗ ܟܠܘܦܐ ܕܐܘܚܠ ܢܦܘܩܬܐ ܕܐܪܥܐ

ܦܘܫܩܐ :

ܥܒ = ܚܝ⃖ ܡܫ⃖

ܥܒ = ܚ ܡܫ ܓܬܒ ܗ ، ܗ = ٩٠ ܒܗܝ ܝܘܩܪܐ ܕܠܘܩܒܠ ܒܝܘܪܚܐ ܠܡܘܪܝܐ ܥܡ ܡܫܬܢܝܢܘܬܐ

= ٢٠ × ٠,٣ × ܓܬܒ ٩٠

= ٦ × ܫܥܝܢܐ

= ܫܥܝܢܐ ܗܢܐ ܘܕܝܢ ܠܝܬ ܥܘܒܕܐ ܚܒܝܪܐ

ܒ. ܡܘܦܩܐ ܙܘܥܢܝܐ Vector product

ܐܢ ܕܡܘܬ ܠܡܘܦܩܐ ܕܬܪܝܢ ܡܫܘܚܬܐ ܐܝܟ $\vec{\text{ܐ}}$ ܘ $\vec{\text{ܒ}}$ ܡܘܦܩܐ ܙܘܥܢܝܐ ܒܕܡܘܬ $\vec{\text{ܐ}} \times \vec{\text{ܒ}}$ ܘܗܘܐ ܦܠܛܐ ܕܡܘܦܩܐ $\vec{\text{ܓ}}$ ܡܫܘܚܬܐ ܙܘܥܢܝܬܐ ܐܢ ܠܘܚܢܐ ܙܘܥܢܐ ܘ ܒܪܫܐ ܕܐܒܪܐ ܝܡܝܢܝܬܐ (ܐ. ܦܬܠܘ ܠܝܕܐ ܙܘܥܢܐ ܕܐܝܕܐ ܝܡܝܢܝܬܐ ܡܢ ܡܫܘܚܬܐ $\vec{\text{ܐ}}$) ܠܡܫܘܚܬܐ ($\vec{\text{ܒ}}$) ܒܕܡܘܬ ܠܡܫܘܚܬܐ ܓ ܕܗܘܐ ܦܠܛܐ ܕܡܘܦܩܐ $\vec{\text{ܐ}} \times \vec{\text{ܒ}}$ ܐܝܟ ܕܒܨܘܪܬܐ (١ — ١٢ ܐ) ܗܢܐ ܘܕܝܢ :

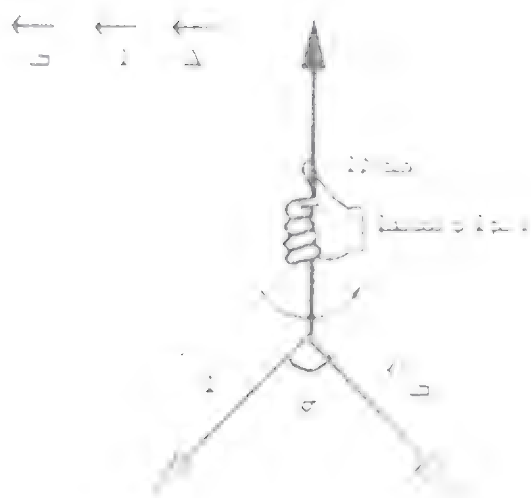
$$\vec{\text{ܓ}} = \vec{\text{ܐ}} \times \vec{\text{ܒ}}$$

ܒܪܘܡܐ ܡܫܘܚܬܐ ܠܦܠܛܐ ܡܘܦܩܐ ܕܐܗܐ ܝܗܒ ܒܥܘܠܐ :

ܓ = ܐ ܒ ܓܒ ܗ ... (١ — ٦)

ܘܗܘܝܐ (ܗ) ܙܘܝܬܐ ܣܒܝܬܐ ܒܝܢ ܡܫܘܚܬܐ $\vec{\text{ܐ}}$. $\vec{\text{ܒ}}$. ܘܫܝܢܝܬܐ ܝܠܗ ܠܣܘܟܐ ܕܙܘܥܢܐ ܕܡܫܘܚܬܐ ܦܠܛܐ ܡܢ ܡܘܦܩܐ $\vec{\text{ܐ}} \times \vec{\text{ܒ}}$ ܝܠܗ ܗܦܟܐ ܒܙܘܥܢܐ ܠܡܫܘܚܬܐ ܦܠܛܐ ܡܢ ܡܘܦܩܐ $\vec{\text{ܒ}} \times \vec{\text{ܐ}}$ ܗܢܐ ܘܕܝܢ

$$\vec{\text{ܐ}} \times \vec{\text{ܒ}} = - \vec{\text{ܒ}} \times \vec{\text{ܐ}}$$



ܨܘܪܬܐ (١ — ١٢ ܐ)

ܡܢ ܦܘܫܩܐ ܥܠ ܡܘܦܩܐ ܙܘܥܢܝܐ ܝܠܗ ܡܫܘܚܬܐ ܕܚܘܡܨܐ ܕܚܝܠܐ $\vec{\text{ܚ}}$ ܕܡܥܒܕ ܥܠ ܦܘܪܡܐ ܚܕܒ ܡܘܫܚܘܬܐ ($\vec{\text{ܡܙ}}$) ܡܢ ܢܩܕܬܐ ܕܚܘܡܨܐ (ܒ) ܐܝܟ ܡܚܘܝܢܐ ܒܨܘܪܬܐ (١ . ١٢ ܒ) ܘܚܘܡܨܐ ܒܗܘܐ :

$$\vec{\text{ܚܡܒ}} = \vec{\text{ܡܙ}} \times \vec{\text{ܚ}}$$

ܬܘܦܣܐ

ܐܢ ܡܥܒܕܠܗ ܚܝܠܐ (ܚ) ܘܥܘܒܕܠܗ ١٠٠ ܢܝܘܛܢ ܒܚܘܛܪܐ ܕܐܘܪܟܐ (٣) ܡܝܬܪܐ ܡܢ ܢܘܩܙܬܐ ܒ ܘܦܪܘܟܐ ٣٠° ܥܡ ܚܕܝܫܐ ܐܝܟ ܒܐܣܟܡܐ (١ — ١٢ ܒ) ܐܝܟܢ ܒܘܬܐ ܕܡܘܡܢܬܐ ܕܚܝܠܐ ܚܕܪ ܢܘܩܙܬܐ (ܒ).

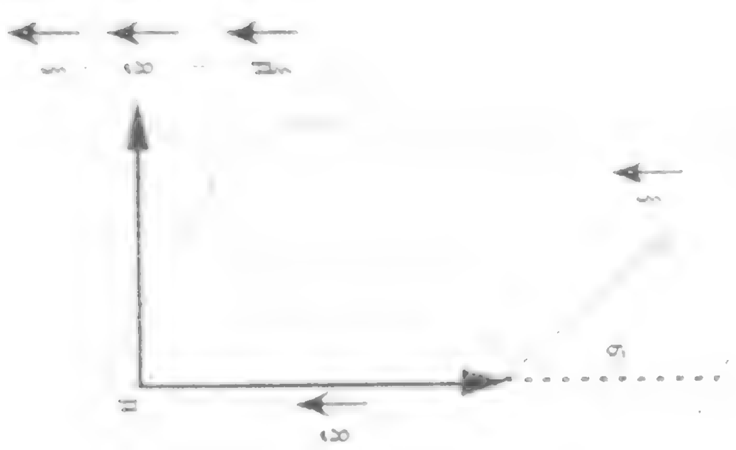
ܫܪܝܐ :

ܡܘܒ⃖ = ܦܘ⃖ × ܚ⃖

ܡܘܒ = ܦܘ ܚ ܣܝܢ ٣٠

$$= ٣ \times ١٠٠ \times \frac{١}{٢}$$

= ١٥٠ ܡܝܬܪܐ ܢܝܘܛܢ



ܨܘܪܬܐ ١ — ١٢ ܒ

ܬܡܪ̈ܝܢܐ

ܬ ١ : ܓܒܝ ܠܦܘܢܵܝܐ ܫܪܝܪܐ ܠܟܠ ܚܕ ܡܢ ܡܵܐ ܕܐܵܬܐ :

(١) ܚܕ ܡܢ ܦܪ̈ܝܫܝܬܐ ܕܐܬܝ ܠܐ ܝܠܗ ܫܪܝܪܐ :

ܐ . ܟܠܝܗܝ ܡܡܢܘ̈ܬܐ ܙܘܓ̈ܐ ܐܝܬܠܗܝ ܙܘܓ̈ܐ

ܒ . ܟܠܝܗܝ ܡܡܢܘ̈ܬܐ ܦܪ̈ܕܢܝܐ ܐܝܬܠܗܝ ܙܘܓ̈ܐ

ܓ . ܟܠܝܗܝ ܡܡܢܘ̈ܬܐ ܙܘܓ̈ܐ ܐܝܬܠܗܝ ܦܘܠܓܐ.

ܕ . ܟܠܝܗܝ ܡܡܢܘ̈ܬܐ ܦܪ̈ܕܢܝܐ ܐܝܬܠܗܝ ܦܘܠܓܐ.

(٢) ܐܝܢܐ ܡܢ ܚܕܝܘ̈ܬܐ ܕܐܬܝ ܡܬܚܫܒܢܐ ܝܠܗ ܕܐܝܬܠܗ ܐܝܟ ܡܡܢܘܬܐ ܡܬܚܫܒܢܝܬܐ :

ܐ) ܡܬܚܫܒܢܐ ܕܝܡܐ ܒ) ܐܝܟ ܗܡ ٣ ܓ) ܢܬܠܬܐ ܕ) ܡ ٣

(٣) ܡܢܝܢܐ ܟܝ ܡܬܚܙܐ ܡܢ ܫܠܝܐ ܠܐ ܦܘܫ ܘܟܘܢܝܗ ܙܘܓ̈ܐ ܦܘܫ ܐܢܝ ܩܘܡܐ ܝܠܗ

ܐ) ١ ܒ) ٣ ܓ) ٢ ܕ) ٤

(4) ܦܘܠܓܐ ܕܟܠܗ ܫܠܝܐ ܗܘܡܐ ܟܡܐ ܢܘܩܙܐ ܘܚܕ ܙܘܓܐ ܦܘܫ :

ܐ) ܟܘܢܝܗ ܒ) ܦܘܪ̈ܫܢܐ ܟܢܫܗ ܓ) ܟܘܦܦܗ ܕ) ܦܠܝܓܘܬܗ

(٥) ܐܢ ܗܘܐ ܐ . ܒ = ܩܘܡܐ ܐܦ ܦܘܠܓܘ ܝܠܗ :

ܐ) ܐ . ܒ ܙܘܓܐ ܒ) ܐ . ܒ ܡܕܘܢܝܐ

ܓ) ܐ . ܒ ܦܘܫܐ ܕ) ܐ . ܒ ܟܢܫܗ ܙܘܓܐ ܟܘܠܗ ٣٧

(٦) ܐܢ ܗܘܐ ܐ ܚܕ ܡܬܚܫܒܢܐ ܟܘܡܐ :

ܐ) ܐ . ܐ = ܩܘܡܐ ܒ) ܐ . ܐ = ܩܘܡܐ

ܓ) ܐ . ܐ = ܐ ٢ ܕ) ܐ . ܐ = − ܐ

(٧) ܐܢܬܐ ܐܝܬ ٨ ܟܡ ܠܐܢܬܐ ܘܡܢ ٥ ܟܡ ܟܘܪܬܐ ٠ ٦ ° ܡܕܝܢ ܐܢܬܐ ܡܬܚܫܒܢܐ ܕܦܘܠܓܐ ܡܢ ܢܘܩܙܐ ܕܟܘܪܬܐ ܟܘܡܐ :

ܐ) ١١ ܟܡ ܒ) ١٢ ܟܡ ܓ) ١٣ ܟܡ ܕ) ١٤ ܟܡ

٨) ܡܥܒܕܢ ܬܪܝܢ ܚܝܠܐ ١٠ ܢܝܘܛܢ. ٥ ܢܝܘܛܢ. ܥܠ ܓܘܫܡܐ ܒܚܕ ܙܒܢܐ.
ܚܝܠܐ ܕܦܘܠܚܢܐ ܥܠ ܓܘܫܡܐ ܗ̇ܘ ܕܗܘܐ:

ܐ) ܒܝܢ ٥ ܘ ١٥ ܢܝܘܛܢ. ܒ) ܒܨܝܪ ܡܢ ٥ ܢܝܘܛܢ.

ܓ) ١٥ ܢܝܘܛܢ. ܕ) ܒܨܝܪ ܡܢ ١٠ ܢܝܘܛܢ.

٩) ܦܘܠܚܢܐ ܕܬܪܝܢ ܚܝܠܐ ٤ ܢܝܘܛܢ ܓܪܒܝܐ ܘ ٣ ܢܝܘܛܢ ܡܕܢܚܐ ܝܠܗ:

ܐ) ܚܕ ܢܝܘܛܢ. ܒ) ٧ ܢܝܘܛܢ.

ܓ) ٥ ܢܝܘܛܢ. ܕ) ١٢ ܢܝܘܛܢ.

١٠) ܙܘܝܬܐ ܒܝܢ ܦܘܠܚܢܐ ܘܚܝܠܐ ܒܡܣܐܠܐ ܕܥܒܪܐ ܡܟܘܫܦܐ ܝܠܗ:

ܐ) ٣٧° ܒ) ٤٥°

ܓ) ٥٣° ܕ) ٦٠°

١١) ܐܢ ܗܘܐ ܐ . ܒ ܬܪܝܢ ܡܫܘܚ̈ܬܐ ܒܚܕ ܙܢܐ. ܐܝܢܐ ܡܢ ܬܪܝܨܐ ܝܠܗ:

١) $\vec{ܐ} \times \vec{ܒ} = \vec{ܒ} \times \vec{ܐ}$

٢) $\vec{ܐ} \times \vec{ܒ} = -\vec{ܒ} \times \vec{ܐ}$

٣) $\vec{ܐ} \times \vec{ܒ} = \vec{ܒ} \times \vec{ܐ}$

٤) $\vec{ܐ} \times \vec{ܒ} = \vec{ܐ} - \vec{ܒ}$

ܫܘܐܠ̈ܐ

ܒ ٢ : ܒܡܦܠܚܬܐ ܕܚܝܠܬܐ ܓܘܢܝܬܐ ܠܒܘܬܪ̈ܐ ܕܡܫܘܚ̈ܬܐ

$\vec{ܓ} = \sqrt{ܐ^{٢} + ܒ^{٢} + ٢\,ܐ\,ܒ\ ܓܬܒ\ ܗ}$

ܡܚܘܝܕ:

١) ܓ = ܐ + ܒ ܐܢ ܡܫܘܚ̈ܬܐ ܐ . ܒ ܗܘܝ ܒܚܕ ܙܘܓܐ.

٢) ܓ = ܐ - ܒ ܐܢ ܡܫܘܚ̈ܬܐ ܐ . ܒ ܗܘܝ ܗܦܟܐ.

٣) $ܓ = \sqrt{ܐ^{٢} + ܒ^{٢}}$ ܐܢ ܡܫܘܚ̈ܬܐ ܐ . ܒ ܒܚܕ ܙܘܓܐ.

ܡ ٣ : ܡܫܘܚܠܦܬܐ ܕܟܘܦܦܐ ܢܘܡܘܣܝܐ ܠܡܪܚܩܬܐ ܐ . ܒ ܡܚܘܝ ܗܘ.
ܕܚܒܝܬܐ ܠܡܒܕܐ.

ܡ ٤ : ܦܘܠܚܢܐ ܕܥܒܕܐ ܚܝܠܐ ܘܡܝܦܐ (٢٠٠ ܢܘܛܢ) ܡܢ ܠܗ ܚܝܠܐ ܕܥܒܕܐ
ܙܘܝܬܐ ܥܡܠܗ (٣٠°) ܟܡ ܦܘܠܚܢܐ ؟ ܦܘܢܝܐ : ١٧٣٫٢٣ ܢܘܛܢ

ܡ ٥ : ܦܘܠܚܢܐ ܕܥܒܕܐ ܚܝܠܐ ܘܡܝܦܐ ١٠٠ ܢܘܛܢ ܘܚܕ ܡܢ ܓܕܘܢܐ ܚܝܠܐ
ܗܘܐ (٨٠) ܢܘܛܢ . ܟܡܐ ܗܘ ܚܝܠܐ ܐܚܪܢܐ ؟ ܦܘܢܝܐ : ٦ ܢܘܛܢ

ܡ ٦ : ܟܕ ܐܢܬ ܓܪܫܬ ܕܐܠܦܐ ܗܘܠܢܐ ܕܥܒܕ ܢܘܦܐ ܠܢܘܡܘܣܐ ܟܕ ܡܘܟܠܬܐ
ܠܢܘܡܘܣܐ ܕܦܘܠܚܢܗ ܠܡܫܕܐܢܐ ܥܠ ܡܕܘܪܐ ܐܚܪܢܐ ܗܘ. ܡܠܘܠܘܬܐ ܕܐܠܦܐ ܕܡܫܐ
ܗܘܬ ٨ ܟܡ ܒܟܕܐ ܘܡܠܘܠܘܬܐ ܕܐܠܦܐ ܟܡܫܐ ܡܠܝܢ ١٦ ܟܡ ܒܟܕܐ ܟܠܡܫܐ
ܙܘܝܬܐ ܠܟܡ ܙܘܟܐ ܕܐܠܦܐ ܗܠܐ ܕܙܝܕ ܟܐܠܦܐ ܕܡܛܝܐ ܠܢܘܡܘܣܐ ܫܠܝܬܐ ؟
ܦܘܢܝܐ : ١٢٠ ܟܡ ܙܘܟܐ ܕܢܘܗܪܐ

ܡ ٧ : ܚܡܫ ܦܘܠܚܢܐ ܕܚܝܠܐ ١٢ ܢܘܛܢ . ١١ ܢܘܛܢ . ١٦ ܢܘܛܢ . ١٥
ܢܘܛܢ . ١٩ ܢܘܛܢ ܘܫܩܝܠܗ ܟܚܕ ܢܩܘܕܐ ܘܡܟܟܒܝܐ ܟܢܘܡܘܣܐ (ܐ) ܐܝܟ
ܡܚܘܝܢܐ ܒܨܘܪܬܐ (١ ـ ١٣).

ܦܘܢܝܐ : ٨٫٩ ܢܘܛܢ ܘܙܘܝܬܐ (٥٠) ܠܓܒܝܢ ܡܕܢܚܐ

ܨܘܪܬܐ (١ — ١٣)

ܬ ٨ : ܐ. ܡܫܘܚܬܐ (ܐ) ܗܘܐ (٨٠) ܣܘܡ. ܡܕܝܢܐ ܘܡܫܘܚܬܐ (ܒ) = (٦٠)

ܡܚܕܐ ܠܕܟܠܐ ܐܢܫ ܦܠܚܐ

(١) ܐ . ܒ   (٢) ܐ × ܒ

ܦ (١) ܗܦܟܐ   (٢) ٨٠٠ : ܡܚܕܐ. ܣܘܡ

ܬ ٩ : ܐܕܐ ܐܠܦܐ ܝܘܡ ܡܕܝܢܐ ܒܡܠܘܠܘܬܐ ٢٠ ܣܡ ܢܟܠܬܐ ܘܠܗ ܠܕܟܒܗ

ܠܡܕܐܝܒ ܐܠܦܐ ܗܕܢܝܐ ܐܕܐ ܒܝܘܡܐ ٣٠ ܡܕܝܢܐ ܠܕܟܢܐ. ܒܡܢܐ ܗܠܐ ܕܗܘܢܐ

ܡܠܘܠܘܬܐ ܕܐܠܦܐ ܗܕܢܝܐ ܕܦܬܚ ܒܠܕܟܢܐ ܕܐܠܦܐ ܡܕܡܢܐ ܒܙܡܢܘܬܐ ؟

ܦܘܢܝܐ : ٤٠ ܣܡ / ܢܟܠܬܐ

ܬ ١٠ : ܗܠܐ ܕܣܬܐ ܗܫܒܬܐ ܒܬܘܦܘ. ܣܐܠܘ ܡܫܘܚܘܬܐ ܕܐܬܘܦܬܐ

ܕܗܘܦܠܬܐ ܥܠ ܒܘܟܕܐ (١٥٠) ܡܚܕܐ ܘܡܫܚܬܐ ܒܡܠܘܠܘܬܐ ١٥

ܡܚܕܐ ܕܦܦܐ ܒܝܘܡܐ ܠܡܘܕܐ ܥܠ ܣܛܪܐ ܕܣܘܪܗ :

ܐ. ܒܐܡܢܐ ܘܡܚܬܐ ܥܠ ܣܛܪܐ ܕܣܘܪܗ ܗܠܐ ܕܝܬܒ ܐܬܘܦܬܗ ܕܡܫܐ

ܠܡܫܘܚܘܬܐ ܕܐܬܘܦܬܐ ܝ. ܡܠܘܠܘܬܐ ܕܠܘܠܐ ܕܐܬܘܦܬܗ ٧٠ ܡܚܕܐ

ܕܦܦܐ ؟

ܒܥܘܡ ܠܘܚܬܐ ܕܐܡܢܐ ܕܡܫܐ ܕܐܬܘܦܬܐ   ܦܘܢܝܐ : ١، ٢٣

ܒ. ܥܠ ܐܡܢܐ ܒܘܟܕܐ ܡܢ ܡܫܘܚܘܬܐ ܕܐܬܘܦܬܐ ܗܠܐ ܕܝܬܒ ܐܬܘܦܬܗ ܕܡܫܐ

ܠܗܘܐ ܐܬܘܦܬܐ ܒܡܫܘܚܘܬܗ ؟   ܦܘܢܝܐ : ٣،٢ ܡܚܕܐ

ܬ ١١ : ܠܕܝܬܠܘ ܦܕܙܘܦܐ ܙܒܕܘܡܐ ܡܘܡܕܘ (١٠٠) ܣܘܡ، ܥܠ ܐܕܟܐ

ܐܘܦܡܬܐ ܘܠܗܐ ܒܝܕ ܣܛܠܐ ܠܟܐ ܒܘܡܬܐ ܒܘܠܗ (٦٠) ܡܢ ܐܘܦܡܐ ܘܠ. ܗܘܐ

ܣܠܐ ܕܕܠܘܣܐ ܕܣܛܠܐ (٨٠) ܣܘܡ. ܒܡܢܐ ܠܗ ܒܘܠܐ ܦܠܣܐ ܠܠܕܟܬܐ

ܕܙܒܕܘܡܐ (٢٥) ܡܚܕܐ ܥܠ ܝܗܣܐ ܕܐܕܟܐ ؟   ܦܘܢܝܐ : ١٠٠٠ ܠܘܠ

ܦܣܘܩܐ ܬܪܝܢܐ ܙܘܥܐ ܘܩܠܝܠܘܬܐ

Motion and Velocity

ܢܒܥ ܢܠܘܦ ܥܠ ܫܘܒܠܐ
ܕܙܘܥܐ ܘܒܪܢ ܒܫܘܬܦܘܬܗ ܘܦܪܢ
ܥܡ ܡܫܚܠܦܘܬܐ ܘܪܗܛܘܬܐ
ܘܩܠܝܠܘܬܐ ܘܐܙܘܠܘܬܐ ܘܒܪܢ
ܐܪܟܐ ܕܙܘܥܐ ܡܨܥܝܐ ܘܠܐ
ܡܨܥܝܐ، ܐܦ ܫܘܪܗܒܐ ܒܝܬ ܬܪܬܐ
ܘܡܕܢܢ̈ܐ، ܐܦ ܒܪܢ ܡܫܘܝܢܫ ܗܘܝܐ
ܥܠ ܫܘܝܐ ܡܫܘܝ̈ܢܐ

(٢ — ١) ܙܘܥܐ Motion

ܟܕ ܡܗܕܝܢܢ ܙܘܥܐ ܕܠܗ ܒܫܘܠܦܐ ܐܡܝܢܐ ܒܕܘܟܬܐ ܕܓܘܫܡܐ ܠܦܘܬ ܕܘܟܬܐ ܕܓܘܫܡܐ ܐܚܪܢܐ ܟܕ ܚܙܝܢܢ ܡܫܘܚܬܐ ܠܕܘܟܬܐ ܕܓܘܫܡܐ ܡܩܕܡܝܐ ܘܦܘܪܫܐ ܒܝܢܬܐ ܐܘ ܡܪܚܩܐ ܕܡܗܠܟܐ ܟܕ ܚܙܝܢܢ ܟܠܗ ܠܦܘܬ ܙܒܢܐ ܗܟܘ ܐܠܐ ܟܕ ܚܙܝܢܢ ܡܫܘܚܬܐ ܒܡܬܠܬܐ ܕܡܦܪܫܐ ܘܙܘܥܗ ܠܦܘܬ ܦܘܪܫܐ ܐܚܪܢܐ ܝܠܢܐ ܥܠ ܐܪܒܥܐ ܗܝ ܓܘܦܐ

ܐܝܬ ܗܫܐ ܐܪܒܥܐ ܐܕܫܐ ܡܢ ܙܘܥܐ ܡܬܝܕܥܐ :

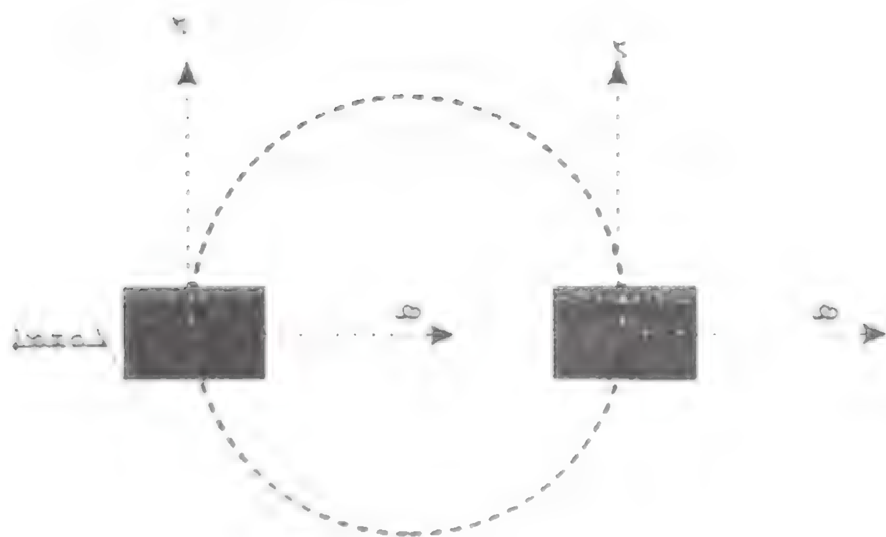
ܐ ـ ܙܘܥܐ ܡܫܢܝܢܝܬܐ Translational Motion

ܟܕ ܡܬܐ ܙܘܥܐ ܡܫܢܝܢܝܬܐ ܐܝܟ ܕܟܕ ܡܬܐ ܗܕܐ ܥܠ ܓܘܫܡܐ ܡܫܘܚܬܐ ܒܟܠܗ ܒܟܠܗ ܕܘܟܬܐ ܕܗܘ ܙܘܥܐ. ܐܘ ܗܘܐ ܙܘܥܐ ܥܠ ܣܪܛܐ ܬܪܝܨܐ ܦܟܠܗ ܡܬܐ ܕܙܘܥܐ ܣܪܛܐ ܐܝܟ ܙܘܥܐ ܕܓܘܫܡܐ ܡܢ ܕܘܟܬܐ ܩܕܡܝܬܐ (١) ܠܕܘܟܬܐ (٢) ܡܚܘܝܐ ܒܐܣܟܡܐ (٢ — ١ ܐ).



ܐܣܟܡܐ (٢ — ١ ܐ)

ܐܦ ܐܢ ܗܘܐ ܙܘܥܐ ܡܫܢܝܢܝܬܐ ܥܠ ܡܕܪܐ ܚܘܕܪܢܝܐ ܦܟܠܗ ܡܬܐ ܕܙܘܥܐ ܚܘܕܪܢܝܐ ܐܝܟ ܡܚܘܝܐ ܒܐܣܟܡܐ (٢ — ١ ܒ) ܐܝܟ ܢܦܘܩܐ ܥܠ ܓܘܠܦܐ ܕܡܕܘܪܐ ܕܦܪܝܣܬܐ ܡܛܝܒܐ.



ܐܣܟܡܐ (٢ — ١ ܒ)

ܓ ـ ܙܘܥܐ ܕܦܪܕܠܬܐ Rotational Motion

ܟܕ ܡܕܢܐ ܙܘܥܐ ܕܦܪܕܠܬܐ ܐܝܟ ܕܐܪܥܐ ܡܢܘܬܐ ܕܡܫܡܫܢܐ ܕܫܡܫܐ ܣܘܪܪܐ ܡܫܘܕܐ ܟܣܕ ܗܕܢܐ. ܟܕ ܡܕܢܐ ܒܡܕܢܐ ܕܦܪܕܠܬܐ ܐܝܟ ܙܘܥܐ ܕܡܪܘܚܬܐ ܕܥܪܒܢܬܐ ܟܠܗ ܚܕ ܗܕܢܐ ܕܦܪܕܠܬܗ. ܘܟܕܢܐ ܕܗܘܐ ܙܘܥܐ ܡܪܟܒܢܐ ܡܢ ܙܘܥܐ ܡܟܝܢܝܐ ܘܙܘܥܐ ܕܦܪܕܠܬܐ ܐܝܟ ܙܘܥܐ ܕܓܝܠܬܐ ܕܪܕܝܬܐ ܒܡܫܚܐ ܕܪܚܫܬܗ.

(٢ – ٢) ܐܘܦܠܘܬܐ Speed

ܟܕܢܐ ܡܫܘܕܥܬܐ ܐܘܦܠܘܬܐ ܕܟܠܗ ܫܘܚܠܦܐ ܡܫܟܚܬܐ ܒܫܘܚܠܦܐ ܕܙܒܢܐ ܐܘ ܟܠܗ ܡܨܥܝܐ ܙܒܢܐ ܠܫܘܚܠܦܐ ܡܫܟܚܬܐ. ܘܟܠܗ ܡܢ ܒܡܫܘܚܬܐ ܒܡܬܠܝܐ ܒܗܘ ܫܘܚܠܦܐ ܟܠܗ ܡܢ ܒܡܫܘܚܬܐ ܒܡܬܠܝܐ.

$$\text{ܐܘܦܠܘܬܐ} = \frac{\text{ܫܘܚܠܦܐ}}{\text{ܙܒܢܐ}}$$ ܘܫܘܕܥܘܬܗ ܡܫܬܐ ܕܦܦܐ ܐܘ ܒܡ / ܫܥܬܐ

(٢ – ٣) ܒܠܘܠܘܬܐ ܘܡܨܥܝܐ ܕܒܠܘܠܘܬܐ

Velocity and Mean Velocity

ܕܟܢܐ ܡܢ ܫܟܚܢ ܗܘܟܠܐ ܕܒܠܘܠܘܬܐ ܐܝܟ ܗܘܟܠܐ ܕܐܘܦܠܘܬܐ ܐܠܐ ܗܘܠܦ ܟܘܢܐ ܦܪܕ ܟܡ ܗܕܘܡܐ ܗܘܟܠܐ ܠܪܕܠܐ ܠܟܘܪܐ ܘܒܠܘܠܘܬܐ ܟܠܗ ܟܘܫܠܦܐ ܙܒܢܐ ܠܡܘܫܚܘܬܐ ܘܟܠܗ ܒܡܫܘܚܬܐ ܙܘܟܢܐ ܘܒܠܘܠܘܬܐ ܟܠܗ ܡܟܫܠܦܐ ܐܝ ܟܘܫܠܦܠܗ ܒܡܫܘܚܬܗ ܐܘ ܟܘܫܠܦܠܗ ܙܘܟܢܗ ܐܘ ܟܘܫܠܦܠܗܘܢ ܗܕܘܡܐ.

$$\text{ܒ} = \frac{\text{ܡܫ}}{\text{ܙ}}$$ ܘܫܘܕܥܘܬܗ ܒ ܕܦܦܐ ܐܘ ܒܡ ܫܥܬܐ

ܡܨܥܝܐ ܕܒܠܘܠܘܬܐ Mean Velocity

ܐܝܟ ܕܐܘܪܚ ܠܡܫܡܫܐ ܡܢ ܢܘܩܙܬܐ (ܐ) ܠܢܘܩܙܬܐ (ܒ) ܡܫܟܚܬܐ ܡܘܫܚܘܬܐ ($\vec{\text{ܡܫ}}$). ܘܡܫܬܟܚܬܐ ܙܒܢܐ (ܙ) ܘܥܒܕ ܐܢܐ ܟܕܢܐ ܕܗܘܐ ܒܒܠܘܠܘܬܐ ܗܕܝܬܐ ܕܒܡܫܘܚܬܐ ܘܙܘܟܢܐ ܐܘ ܡܟܫܠܦܐ ܕܒܡܫܘܚܬܐ ܐܘ ܙܘܟܢܐ ܐܘ ܗܕܘܡܐ ܟܡ ܚܕܪܐ ܘܟܠܗ ܐܝܟܘܬܐ ܕܙܘܥܐ ܟܠܗܘܢ ܗܘܐ ܡܨܥܝܐ ܕܒܠܘܠܘܬܗ

$$\vec{\text{ܒ}} = \frac{\vec{\text{ܡܫ}}}{\text{ܙ}} \quad \ldots\ldots (٢ - ١)$$

ܒ. ܒܘܣܠܦܠܗ ܩܠܝܠܘܬܐ ܕܓܘܫܡܐ ܒܙܘܥܐ ܡܫܘܚܠܦܬܐ ܘܩܠܝܠܘܬܗ
ܒܪܘܫܝܐ ($ܩ_١$) ܘܩܠܝܠܘܬܗ ܒܚܪܬܐ ($ܩ_٢$) ܡܨܥܝܬܐ ܕܩܠܝܠܘܬܗ ܦܫ ܡܕܡܝܐ
ܟܡܨܥܝܬܐ ܕܩܠܝܠܘܬܐ (ܡܨܩ) ܟܡܢܝܢܐ ܕܙܒܢܐ ܕܫܘܠܦܐ ܕܩܠܝܠܘܬܗ.

$$ܡܨܩ = \frac{ܩ_١ + ܩ_٢}{٢} \quad \ldots (٢ — ٢)$$

ܛܘܦܣܐ

ܫܪܝܠܗ ܓܘܫܡܐ ܡܢ ܢܘܩܙܐ (ܐ) ܒܩܠܝܠܘܬܐ ١٠ ܣܡ ܒܫܢܝܬܐ ܙܘܥܗ ܡܥܪܒܐ ܘܥܕܡܐ (٣) ܫܢܝܐ ܡܫܚܠܦܠܗ ܒ ܒܬܪ ܕܐܙܠܗ ܠܓܪܒܝܐ ܒܩܠܝܠܘܬܐ ܡܫܪܪܬܐ ܒܬܪܗ (٢٠) ܣܡ ܒܫܢܝܬܐ ܘܡܫܚܠܦܠܗ ܢܘܩܙܐ ܕ ܒܬܪ (٥) ܫܢܝܐ ܡܢ ܫܘܪܝܐ ܕܙܘܥܗ ܨܘܪܬܐ (٢ — ٢).

ܐ. ܟܡܐ ܝܠܗ ܡܨܥܝܬܐ ܕܐܙܠܘܬܗ ܒܝܢ ܦܪܘܫܐ ܢܘܩܙܐ ܐ . ܕ ؟

ܒ. ܟܡܐ ܝܠܗ ܡܨܥܝܬܐ ܕܩܠܝܠܘܬܗ ܒܝܢ ܦܪܘܫܐ ܢܘܩܙܐ ܐ . ܕ ؟

ܫܪܝܐ

ܐ. ܟܘܠܐ ܕܡܘܫܚܬܐ $\overleftarrow{ܐ ܒ}$ = ܩ ܙ = ١٠ × ٣ = ٣٠ ܣܡ ܡܥܪܒܐ.

ܟܘܠܐ ܕܡܘܫܚܬܐ $\overleftarrow{ܒ ܕ}$ = ܩ ܙ = ٢٠ × ٢ = ٤٠ ܣܡ ܓܪܒܝܐ

ܪܚܩܘܬܐ ܕܡܫܚܠܦܠܗ ܓܘܫܡܐ ܒܙܘܥܗ ܝܠܗ ܓܘܒܪܐ ܕܡܫܘܚܬܐ ܕܬܪܬܝܢ.

٣٠ + ٤٠ = ٧٠ ܣܡ

$$ܡܨܥܝܬܐ\ ܕܐܙܠܘܬܗ = \frac{ܪܚܩܘܬܐ}{ܙܒܢܐ}$$

$$= \frac{٧٠}{٥} = ١٤\ ܣܡ\ ܒܫܢܝܬܐ$$

ܟܘܠܐ ܕܡܘܫܚܬܐ

$$\overleftarrow{ܐ ܕ} = \sqrt{٣٠^٢ + ٤٠^٢} = ٥٠\ ܣܡ$$

$$ܛܠ\ ܗ = \frac{٤٠}{٣٠} = \frac{٤}{٣}$$

ܨܘܪܬܐ (٢ — ٢)

ܡܪܝܬܐ ܕܩܠܝܠܘܬܗ = $\frac{\text{ܡܘܫܚܬܐ}}{\text{ܙܒܢܐ}}$ = $\frac{٥٠}{٥}$ = ١٠ ܡܛ ܒܟܠܐ ܒܪܦܦܐ
٥٣° ܠܓܒܝ ܡܕܢܚܐ

(٢ — ٤) ܣܘܪܗܒܬܐ ܡܫܘܚܬܐ Uniform Acceleration

ܐ. ܐܢ ܗܘܝܐ ܩܠܝܠܘܬܐ ܕܓܘܫܡܐ ܫܚܠܦܬܐ ܒܗܘܝܐ ܡܫܚܠܦܐ ܕܟܡܝܐ ܐܘ ܡܫܚܠܦܐ ܕܙܘܪܐ ܐܘ ܡܫܚܠܦܐ ܕܟܡܝܐ ܘܙܘܪܐ ܒܗ ܚܕܕܐ. ܘܦܬܐ ܐܡܚܕܬܐ ܕܠܓܘܫܡܐ ܣܘܪܗܒܬܐ ܗܕ ܒܡܕ ܕܐܗܐ ܦܫ ܡܫܚܠܦܐ ܣܘܪܗܒܬܐ ܕܝܠܗ ܒܫܠܦܬܐ ܕܩܠܝܠܘܬܐ ܒܚܕܝܘܬܐ ܕܙܒܢܐ ܐܘ ܒܫܘܠܦܐ ܙܒܢܐ ܠܩܠܝܠܘܬܐ. ܘܒܕ ܩܠܝܠܘܬܐ ܝܠܗ ܒܟܡܝܘܬܐ ܙܘܦܬܐ ܒܡܕ ܕܐܗܐ ܣܘܪܗܒܬܐ ܝܠܗ ܒܟܡܝܘܬܐ ܙܘܦܬܐ ܘܙܘܪܐ ܝܠܗ ܙܘܪܐ ܕܒܘܫܠܦܐ ܕܩܠܝܠܘܬܗ ܒܗܕܗ.

$$\text{ܣܪ} = \frac{\text{ܒܘܫܠܦܐ ܕܩܠܝܠܘܬܐ}}{\text{ܙܒܢܐ}} = \frac{\text{ܩ}\ \backslash}{\text{ܙ}\ \backslash}$$

ܘܒ. ܒܘܫܠܦܐ ܕܩܠܝܠܘܬܐ ܝܗܘܐ ܫܚܝܐ ܒܟ ܙܒܢܐ ܒܗܘܐ ܣܘܪܗܒܬܐ ܡܫܘܚܬܐ ܗܢܐ ܘܒܝ

$$\text{ܣܪ} = \frac{\text{ܩ}_{٢} - \text{ܩ}_{١}}{\text{ܙ}} \quad \ldots (٢ — ٣)$$

ܘܚܕܝܘܬܗ ܝܠܗ ܦܠܓܐ ܕܦܠܓܘܬܐ ܕܚܕܝܘܬܐ ܕܩܠܝܠܘܬܐ ܥܠ ܚܕܝܘܬܐ ܕܙܒܢܐ ܘܒܗܘܐ

ܡ ܕܦ ܕܦ = ܡ ܕܦ ٢

ܘܒܕܐ ܕܗܘܐ ܣܘܪܗܒܬܐ ܫܚܝܐ ܕܟܡܝܐ ܘܦܫ ܡܕܐ ܒܣܘܪܗܒܬܐ ܡܫܘܚܬܐ ܐܝܟ ܣܘܪܗܒܬܐ ܕܓܘܫܡܐ ܚܠܕܐ ܕܢܦܠܐ ܐܘ ܗܘܐ ܡܫܚܠܦܐ ܒܟܡܝܐ ܐܘ ܒܙܘܪܐ ܐܘ ܒܟܕܘܝܗ ܒܗ ܚܕܕܐ ܘܐܗܐ ܝܠܗ ܠܒܕ ܡܢ ܐܝܠܐ ܕܕܟܝܐ. ܒܟܕܟܐ ܕܩܝܡ ܒܡܕ ܕܐܗܐ ܕܕܟܝܐ ܒܗܘܝܐ ܚܒܝܫܬܐ ܒܣܘܪܗܒܬܐ ܡܫܘܚܬܐ:

ܦܫ ܡܕܐ ܣܘܪܗܒܬܐ ܡܠܠܬܐ ܐ. ܦܠܓܠܗ ܡܢ ܙܒܕܬܐ ܓܘ ܩܠܝܠܘܬܐ ܕܓܘܫܡܐ ܘܦܫ ܡܕܐ ܒܨܕܬܐ ܐ. ܦܠܓܠܗ ܡܢ ܒܨܕܬܐ ܓܘ ܩܠܝܠܘܬܐ ܕܓܘܫܡܐ.

(٢ — ٥) ܡܫܘܝܬܐ ܕܙܘܥܐ ܫܚܠܦܐ ܒܡܘܪܒܐ ܒ ܡܫܚܠܦܐ

$$ܓܒ\ ܠ = \frac{ܣ_٢ \quad ܣ_١}{ܙ}$$

$$ܣ_٢ = ܣ_١ + ܠ\ ܙ \quad \ldots\ldots\ (٢ — ٤)$$

ܘܓܒ ܙ = ܡܨ ܣ ، ܘܒܡܫܠܡܘܬܐ ܡܢ ܓܒܐ $\quad ܡܨ\ ܣ = \dfrac{ܣ_١ + ܣ_٢}{٢}$

$$ܕܦܠܛ\ ܙ = \frac{ܣ_١ + ܣ_٢}{٢} \times ܙ$$

ܘܒܡܫܠܡܘܬܐ ܡܢ ܓܒܐ ܣ٢
ܒܡܘܣܠܬܐ (٢ — ٤)

$$ܕܦܠܛ\ ܙ = \frac{(ܣ_١ + ܣ_١ + ܠ\ ܙ)}{٢} \times ܙ$$

$$ܙ = ܣ_١\ ܙ + \frac{١}{٢} ܠ\ ܙ^٢ \quad \ldots\ (٢ — ٥)$$

$$ܘܓܒ\ ܠ = \frac{ܣ_٢ - ܣ_١}{ܙ}\ ,\quad ܙ = \frac{ܣ_٢ \quad ܣ_١}{ܠ}$$

$$:\ ܡܨ\ ܣ = \frac{ܣ_٢ + ܣ_١}{٢}$$

ܐܠܐ ܙ = ܡܨ ܣ ܙ

$$ܙ = \frac{ܣ_٢ + ܣ_١}{٢} \cdot \frac{ܣ_٢ - ܣ_١}{ܠ}$$

$ܩ_{٢}^{٢} - ܩ_{١}^{٢} = ٢ ܘ ܛ$

$ܩ_{٢}^{٢} = ܩ_{١}^{٢} + ٢ ܘ ܛ$ (٢ — ٦)

ܬܘܦܣܐ

ܘܒܕܠܗ ܡܛܪܬܐ ܡܢ ܫܠܘܬܐ ܡܢ ܡܫܪܝܬܐ (ܐ) ܒܣܘܪܗܒܐ ܡܛܟܣܐ ܘܟܠ ܚܕܬܐ ܕܩܝܩܐ ܘܡܛܝܠܗ ܢܘܩܙܬܐ (ܒ) ܕܒܬܪ (٢) ܕܩ ܡܢ ܡܫܪܝܬܐ (ܐ) ܒܩܠܝܠܘܬܐ ܡܛܟܣܬܐ ܕܡܛܠܗ ٧٢ ܟܡ / ܫܥܬܐ ܒܪ ܕܫܩܠܗ ܒܗܕܐ ܩܠܝܠܘܬܐ ܗܠ ܡܛܝܠܗ ܢܘܩܙܬܐ (ܓ) ܒܬܪ (٠.٥) ܫܥܬܐ ܡܢ ܥܘܕܪܐ ܕܘܟܬܗ ܒܪ ܡܫܘܚܠܗ ܡܟܠܝܢܐ ܕܟܠܐ ܠܗ ܡܫܪܝܬܐ (ܗ) ܕܡܛܝܠܗ ܟܠܗ ܒܪܕ (٣٥) ܡܛܟܝܢܐ ܡܢ ܥܘܕܪܐ ܕܘܟܬܗ. ܫܟܚܢ ܡܢ ܕܐܬܐ :

١ . ܗܘܕܥܬܐ ܕܘܟܬܐ ܕܡܛܪܬܐ ܘܪܚܩܗ ܡܢ ܡܫܪܝܬܐ (ܐ) ܗܠ ܡܛܝܬܗ ܠܢܘܩܙܬܐ (ܒ).

٢ . ܒܘܟܕܐ ܒܝܢ ܡܫܪܝܬܐ (ܐ) ܘܢܘܩܙܬܐ (ܓ).

٣ . ܗܘܕܥܬܐ ܕܡܛܪܬܐ ܘܒܘܟܕܐ ܕܡܛܝܠܗ ܒܝܢ ܢܘܩܙܬܐ (ܓ) ܘܡܫܪܝܬܐ (ܗ).

٤ . ܡܝܬܐ ܕܩܠܝܠܘܬܐ ܕܡܛܪܬܐ ܒܝܢ ܬܪܘܢ ܡܫܪܝܬܐ ܐ . ܗ.

ܫܪܝܐ :

$$٧٢ \text{ ܟܡ / ܫܥܬܐ} = \frac{٧٢ \times ١٠٠٠}{٣٦٠٠} = ٢٠ \text{ ܡܬܪ / ܪܦܦܐ}$$

ܪܗܛܐ ܒܩܠܝܠܘܬܐ ܡܛܟܣܬܐ ܪܗܛܐ ܒܩܠܝܠܘܬܐ ܡܛܟܣܬܐ ܪܗܛܐ ܒܩܠܠܬܐ

٢ ܕܩ . ٢٠٠٠ ܡܬܪܐ

$ܩ_{١}$ $ܩ_{٢}$ $ܩ_{٣}$

ܐ ܒ ܓ ܗ

$ܩ_{٢}$ ٢٠ ܡ/ܪ $ܩ$ ٢٠ ܡ/ܪ $ܩ_{٣}$ ܣܦܝܪܐ

$٢ \text{ ܕܩ} = ٢٠٠٠ \text{ ܪ}$

$$\frac{١}{٢} \text{ ܫܥܬܐ} = \frac{٣٦٠٠}{٢} = ١٨٠٠ \text{ ܪܦܦܐ}$$

١) ܓܘ ܡܫܝܚܘܬܐ (ܐ ܒ) ܪܗܛܐ ܗܘܐ ܒܫܠܠܬܐ ܡܫܘܚܬܐ. ܡ١ = ܣܘܝܡܐ. ܡ
٢٠ ܡ ܪܦܦܐ. ܒܡܦܠܚܬܐ ܕܐܘܡܠܬܐ ܡ٢ ² = ܡ١ ² + ٢ ܕ ܠ

(٢٠)² = ܣܘܝܡܐ + ٢ ܠ × ٢٠٠

٤٠٠ = ܣܘܝܡܐ + ٢ ܠ × ٢٠٠

ܠ = ١.٠ ܡܬܪ ܪܦ²

٢) ܓܘ ܡܫܝܚܘܬܐ (ܒ ܓ) ܪܗܛܐ ܗܘܐ ܒܫܘܠܘܡܘܬܐ ܡܫܘܚܬܐ؛
ܘܒܝܬ ܕܪܗܛܐ ܕܡܫܘܚܬܐ ܒܝܢ (ܒ ، ܓ) = ١٨٠٠ - ٢٠٠ = ١٦٠٠ ܪܦܦܐ
ܡܫܝܚܘܬܐ ܒ ܓ = ܡ ܙ = ܡ ܙܒܢܐ ܡܫܘܚܬܐ ܙܒܢܐ = ܡ٢ ܒܡܫܚܠܦܢܘܬܐ
ܕܡܠܠܬܐ
= ٢٠ × ١٦٠٠
= ٣٢٠٠٠ ܡܬܪܐ
٣) ܓܘ ܡܫܝܚܘܬܐ (ܓ ܕ) ܪܗܛܐ ܗܘܐ ܒܒܨܘܪܬܐ ܡܫܘܚܬܐ:
٣٥ ܡܫܘܚܬܐ = ٣٥ × ٦٠ = ٢١٠٠ ܪܦܦܐ
ܘܒܝܬ ܕܪܗܛܐ ܕܡܫܘܚܬܐ ܡܢ ܢܩܘܕܬܐ ܕ ܠܡܫܚܠܦܐ ܗ = ٢١٠٠ - ١٨٠٠ = ٣٠٠
ܪܦܦܐ
ܡ١ ܠܡܫܚܠܦܐ ܕܒܨܘܪܬܐ = ܣ ܡܫܘܚܬܐ

$$ܠ_2 = \frac{ܡ_2 - ܡ_1}{ܙ} = \frac{ܣܘܝܡܐ - ٢٠}{٣٠٠} = -\frac{1}{15} \text{ ܡ ܪܦ}^2$$

ܘܐܡܪܐ ܐܠܦܐ ܓܘ ܡܫܘܚܬܐ ܚܣܘܪܐ ܕܒܠܗ ܕܒܨܘܪܬܐ

ܒܡܬܪܐ ܕ ܗ = ܡ٣ = ܡ٢ ܡ١

$$ܠ_2 = \frac{ܡ_2 + ܡ_1}{2} ،$$

ܐ ٢ = (ܩܒܝܬܐ + ٢٠) / ٢ . ٣٠٠

= ٣٠٠٠ ܡܝܬܪܐ

٤) ܡܝܢܐ ܕܡܠܘܠܘܬܐ = ܟܘܠܐ ܕܡܘܫܚܘܬܐ ܚܠܝܦܬܐ / ܙܒܢܐ ܚܠܝܦܐ = (|ܡܘ ١| + |ܡܘ ٢| + |ܡܘ ٣|) / ܙ

ܡܝܢܐ ܕܡܠܘܠܘܬܐ = (٣٠٠٠ + ٣٢٠٠ + ٣٠٠) / (٣٥ × ٦٠)

= ٣٧٠ / ٢١ = ١٧.٦٢ ܡ ܪܦ

(٢ — ٦) ܫܘܪܘܥܬܐ ܚܐܪܬܐ (ܓ)

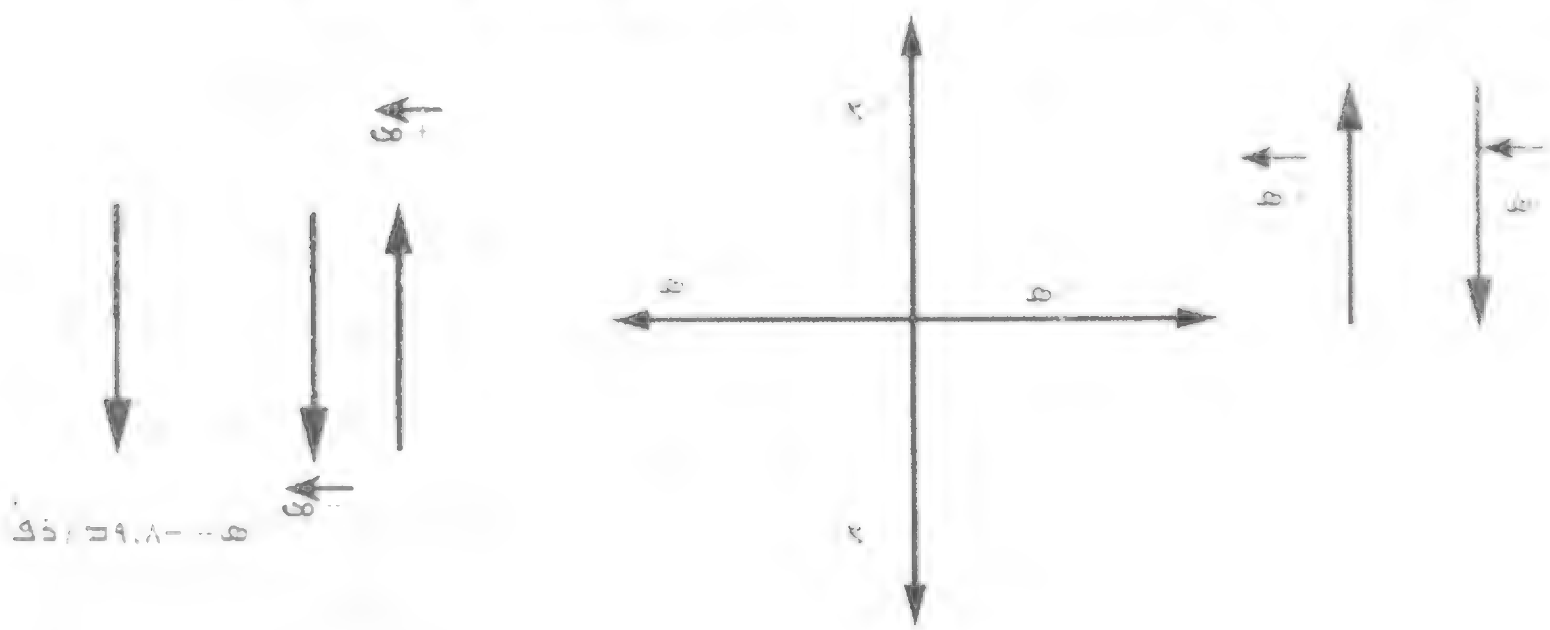
ܚܫܒܠܗ ܦܝܠܣܘܦܐ ܝܘܢܝܐ ܐܝܟ ܐܪܣܛܘ (٣٨٤ — ٣٢٢) ܩ.ܡ ܕܓܘܫܡܐ ܝܩܝܪܐ ܐܝܟ ܟܐܦܐ ܕܣܦܪܐ ܘܡܐܦܐ ܢܦܠ ܒܥܓܠ ܝܬܝܪ ܡܢ ܓܘܫܡܐ ܩܠܝܠܐ ܐܝܟ ܓܕܦܐ ܕܛܝܪܐ ܘܦܬܐ ܠܐ ܝܗܒܐ ܠܦܘܪܫܢܐ ܕܒܙܒܢܐ ܕܡܦܠܐ ܠܐܪܥܐ ܠܓܘܫܡܐ ܦܪܝܫܐ. ܘܦܫܠܗ ܐܗܐ ܚܫܒܐ ܦܪܝܫܐ ܥܠ ܦܠܓܐ ܕܫܢܝܐ ܐܚܪܢܝܐ ܕܠܠܗ ١٦٠٠ ܕܡܘܠܕܐ ܕܓܠܝܠܘ ܢܣܝܐ ܦܪܝܫܐ ܒܐܗܐ ܡܠܘܐܐ ܘܚܙܠܗ ܠܘܬܐܐ ܡܢ ܗܘܠܐ ܦܪܝܫܐ ܒܡܫܐ ܒܓܠܓܠܐ ܘܦܪܝܫܐ ܒܝܘܩܪܐ ܘܡܘܢܩܠܠܗ ܒܚܕ ܙܒܢܐ ܡܢ ܥܠܘܬܐ ܡܢ ܡܕܢܚܐ ܕܡܘܓܠܐ ܕܒܝܙܐ ܡܝܡܘܬܐ ܘܚܙܠܗ ܕܡܛܝ ܠܐܪܥܐ ܡܘܓܪܡܐ ܙܒܢܐ ܒܐܕܗ ܡܘܪܟܒܐ.

ܦܪܫܠܗ ܡܢ ܕܐܗܐ ܕܡܠܘܠܘܬܐ ܝܕܝܥܬܐ ܙܒܢܬܐ ܠܐܝܟ ܠܘܓܪܬܐ ܒܡܘܢܐ ܝܠܗ ܟܡܐ ܕܝܠܦܝ ܗܡܙܡܝ. ܗܢܐ ܘܕܝܢ ܫܘܪܘܥܝܗ ܚܕ ܝܠܗ ܘܗܘ ܝܠܗ ܫܘܪܘܥܬܐ ܚܐܪܬܐ ܦܠܝܓܬܐ ܡܢ ܚܝܠܐ ܕܢܓܕܬܐ ܕܐܪܥܐ ܠܐܝܟ ܠܘܓܪܬܐ.

ܡܟܘܢܠܐ ܕܐܗܐ ܫܘܪܘܥܬܐ ܓ ܡܕܝܢ (٩.٨−) ܡܝܬܪܐ ܪܦ^2 ܠܝܕ ܒܡܘܢܐ ܕܝܬܝܐ ܕܝܡܐ ܘܫܝܬܐ ܕܦܬܝܘܬܐ ٤٥.

ܗܟܝܢ ܚܝ̈ܠܘܬܐ ܡܬܚܒ̈ܫܬܐ ܕܟܠ ܡܢ ܡܬܚܫܘܬܐ ܘܡܠܘܠܘܬܐ ܕܡܫܢܝܬܐ ܘܡܫܬܢܝܐ ܡܢ ܢܓܕܢܘܬܐ ܕܐܪܥܐ ܣܘܡܟܐ (+) ܒܗܝ ܕܒܠܒܗ ܒܨܘܪܬܐ ܕܣܪܛܐ (+ܙ) ܘܦܬܝ ܚܝ̈ܠܘܬܐ ܡܬܚܒ̈ܫܬܐ ܡܬܒܢܝܐ ܘܡܫܬܢܝܐ ܡܢ ܢܓܕܢܘܬܐ ܕܐܪܥܐ ܠܠܘܬ (−) ܒܗܝ ܕܒܠܒܗ ܒܨܘܪܬܐ ܕܣܪܛܐ (−ܙ) ܐܝܟ ܕܒܨܘܪ̈ܬܐ (٢ — ٣) (٢ — ٤) ܘܟܕ ܡܬܚܒ̈ܫܬܐ ܕܣܘܪܗܒܬܐ ܐܪܥܢܐ ܠܗ ܘܡܫܬܢܝܐ ܘܪܘܒ ܡܢܝܢܗ. ܕܐܪܥܐ ܐܣܝܪܐ ܒܗܘ ܕܐܝܬ ܗܘܐ ܕܟܝܗ ܠܠܘܬ (−) ܐܣܝܪܐ ܗܢܐ ܘܕܝܢ ܣ = ٩٫٨ ܡ/ܪܦ² ܐܝܟ ܡܚܘܝܢܐ ܒܨܘܪܬܐ (٢ ـ ٤).

ܚܠܦ ܒܗܠܝܢ ܕܣܘܪܗܒܐ ܐܪܥܢܐ ܡܢ ܢܘܡܘܣܐ ܠܐܣܪܝܬܐ ܟܠ ܢܓܕܢܐ ܕܒܗܘܬܐ ܐܪܥܢܝܬܐ ܠܗܘܢ ܕܡܬܐ ܕܒܗ ܢܘܡܘܣܐ ܐܘ ܚܝܠܗ ܡܢ ܒܗܬܐ ܕܢܓܕܢܐ ܕܡܬܐ ܒܕ ܒܪܒ ܒܗܠܝܢ ܕܣܘܪܗܒܐ ܒܗܢܐ ܕܐܡܬܐ ܐܘ ܢܘܡܘܣܐ ܡܢ ܢܓܕܢܐ ܕܐܪܥܐ ܐܦ ܒܠܦܐ ܐܘ ܢܘܡܘܣܐ ܠܗܘܢ ܢܘܩܦܗ ܟܠ ܚܠܘܦܐ ܕܡܬܢܘܬܐ



ܨܘܪܬܐ (٢ — ٣)

ܨܘܪܬܐ (٢ — ٤)

(٢ — ٧) ܢܦܠܬܐ ܚܐܪܬܐ ܕܓܘܫܡ̈ܐ Freely Falling Bodies

ܗܘܐ ܓܘܫܡܐ ܕܢܦܠ ܢܦܠܬܐ ܚܐܪܬܐ ܗܘ ܓܘܫܡܐ ܡܬܚܪܟܢܐ ܘܡܫܬܢܝܐ ܒܣܘܪܗܒܐ ܩܒܘܥܐ ܡܢ ܢܓܕܢܘܬܐ ܕܐܪܥܐ ܡܬܚܫܒܢܐ ܚܝܠܐ ܕܝܘܩܪܗ ܠܗ ܒܠܚܘܕ.

ܐ. ܡܬܚܫܒܝܢ ܦܓܪܐ ܡܢ ܪܘܡܐ ܘܦܪܐ ܕܦܓܪܐ ܠܟܠ ܕܦܓܪܝܢ ܠܐ ܡܬܚܫܒܐ ܡܢ ܦܘܫܐ ܘܦܬܠܒܗ ܒܚܡܐ ܕܢܦܠ ܒܚܕ ܚܕܪܐ ܡܢ ܢܓܕܢܐ ܒܕ ܦܓܪܐ ܦܓܪܐ ܕܪܘܡܐ ܠܐܬܪܐ ܕܦܓܪܢܐ ܡܕܡ ܦܓܪܐ ܕܦܪܐ ܠܗ ܐܝܟ ܕܒܨܘܪܬܐ (٢ — ٥ ١).

ܓܘ ܦܘܫܐ
ܡܬܒܐ ܡܬܒܐ
ܕܘܪܐ ܠܐܝܢܬܐ
ܕܡܗܬܘܬܐ ܡܕܐܒܕ
ܡܬܒܐ ܕܦܕܐ

(ܐ)

ܓܘ ܡܣܘܡܐ
ܡܬܒܐ ܕܘܪܐ
ܘܦܕܐ ܢܩܠܒ ܒܣܕ
ܚܕܢܐ ܕܡܣܝܚܐ ܒܘܚܐ
ܒܒܠܗ ܚܕܢܐ

(ܒ)

ܐܣܟܡܐ (٢ — ١)

ܐܟܐ ܐ. ܦܫܠܘ ܡܣܘܦܬܐ ܡܗܬܘܬܐ ܡܢ ܦܘܫܐ ܡܦܩܬܐ ܠܟܠܗܝܢ ܘܦܫܠܘ ܐܢܫܐ ܢܣܒܢܐ ܠܗܐ ܐܣܕܪܐ ܒܣܘܪܐ ܕܡܬܠܬܐ ܕܘܪܐ ܘܦܕܐ ܡܬܒ ܠܐܢܫܐ ܕܡܗܬܘܬܐ ܒܣܕ ܚܕܢܐ ܐܝܟ ܒܐܣܟܡܐ (٢ — ٥ ܒ) ܡܢ ܕܡܣܘܐ ܕܡܫܕܘܒܐ ܕܠܗܡܐ ܒܡܐܣܐ ܕܢܩܠܬܗ ܣܕܪܐ ܒܒܡܐ ܕܟܘܪܐ ܕܦܘܫܐ ܗܘܐ ܣܕ ܒܘܠܐ ܠܗ ܡܫܕܘܒܐ ܐܕܠܐ (ܡ).

ܡܢܘܢ ܕܢܩܠܬܐ ܣܕܪܐ ܕܠܗܡܐ ܗܘܝ ܡܢܘܢ ܕܘܡܠܐ ܣܗܝܢܐ ܒܢܬܗ ܥܠ ܣܠܐ ܐܕܝܐ ܒܡܫܕܘܒܐ ܡܬܒܡܐ ܒܣܒܪܬܐ ܕܡܫܕܘܒܐ ܥܠܗ ܡܫܕܘܒܐ ܐܕܠܐ (ܡ) ܘܐܝܟ ܕܐܬܐ:

$$\text{ܡ}_{٢} = \text{ܡ}_{١} + \text{ܛ}\,\text{ܙ} \quad \ldots\ldots \quad (٢ — ٧)$$

$$\text{ܡܘ} = \text{ܡ}_{١}\,\text{ܙ} + \frac{١}{٢}\,\text{ܛ}\,\text{ܙ}^{٢} \quad \ldots\ldots\ldots \quad (٢ — ٨)$$

$$\text{ܡ}_{٢}^{\,٢} = \text{ܡ}_{١}^{\,٢} + ٢\,\text{ܛ}\,\text{ܘ} \quad \ldots\ldots\ldots \quad (٢ — ٩)$$

ܥܠ ܒܕܟܬܐ (ܡܘ) ܥܠܗ ܡܘܒܝܠܘܬܐ ܘܡܦܩܢܬܐ.

ܛܘܦܣܐ

ܢܦܠܠܗ ܟܐܦܐ ܡܢ ܡܕܡܟܬܐ ܕܪ̈ܘܡܐ ܐܡܘܬܗ (٢٠) ܡܝܛܪܐ. ܚܫܘܒ ܗܢܐ ܕܐܬܐ

ܐ - ܡܠܘܠܘܬܐ ܕܟܐܦܐ ܒܝܕ ܕܠܡܛܝܬܗ ܒܓܘܫܡܐ ܕܐܪܥܐ.

ܒ - ܙܒܢܐ ܕܡܘܬܪܟܠܗ ܟܐܦܐ ܒܢܦܠܬܐ.

ܚܫܘܒ ܗ = − ١٠ ܡ \ ܪܦ ٢

ܥܢܝܐ

ܐ - ܡܘ = − ٢٠ ܡܝܛܪܐ ܚܘܒ ܐܫܘܝܘܬܐ (٢ — ٦)

ܡ٢ ٢ = ܡ١ ٢ + ٢ ܘ ܠ

ܡ٢ ٢ = ܣܦܝܩܐ + ٢ (−١٠) (−٢٠)

ܡ ٢ = + ٢٠ ܡܝܛܪܐ \ ܪܦܦܐ

ܘܟܕ ܙܘܥܐ ܕܡܠܘܠܘܬܐ ܒܝܘܪܚܐ (−ܨ)

ܡ٢ = − ٢٠ ܡܝܛܪܐ \ ܪܦܦܐ

ܒ - ܟܕ ܡ٢ = ܡ١ + ܠ ܙ

− ٢٠ = ܣܦܝܩܐ + (−١٠) ܙ

− ܙ = ٢ ܪܦܦܐ

ܐܫܘܝܘܬܐ (٢ — ٦)

ܛܘܦܣܐ

ܫܕܝܠܗ ܠܟܘܪܐ ܡܢ ܬܠܝܬܐ ܡܢ ܠܥܠ ܕܓܘܫܡܐ ܚܠܝܐ ܒܡܠܘܠܘܬܐ ܫܘܪܝܝܐ (٣) ܡܝܛܪܐ ܘܒܙܘܝܬܐ ܒܙܘܝܬܐ (٣٧ °) ܡܢ ܐܦܩܐ ܐܝܢ ܗܘܐ ܚܠܒ ٣٧ = ٠٫٦

ܘܡܘܠܐ ܗ = ١٠ ܡ \ ܪܦ ٢ ܚܫܘܒ ܗܢܐ ܕܐܬܐ :

ܐ - ܗܘܪܘܟܐ ܕܟܘܪܐ ܥܠ ܓܘܫܡܐ ܚܠܝܐ.

ܒ - ܐܪܘܠܘܬܐ ܕܟܘܪܐ ܟܕ ܠܓܘ ܕܓܘܫܡܐ.

ܓ - ܙܒܢܐ ܐܝܡܢܐ ܠܡܛܝܬܐ ܕܟܘܪܐ ܠܓܘ ܕܓܘܫܡܐ ܚܠܝܐ



ܨܘܪܬܐ (٢ — ٧)

ܫܪܝܐ

ܟܕ ܡܫܘܚܬܐ ܐܪܥܢܝܬܐ ܡܬܚܫܒܢܐ ܠܗ ܒܗܘܐ ܡܪܟܒܘ ܒܙܘܓܐ ܕܠܓܒܗ ܕܡܝܠܢܐ ܠܝܢܐ ܒܗܘܐ ܗ ܠܒ ٣٧ ܣܘܝ ܨܘܪܬܐ (٢ — ٧) ܒܡܕ ܕܐܘܐ ܒܗܘܐ ܘܡܢܐ ܕܠܗܩܡܐ ܥܠ ܡܝܠܢܐ ܠܝܢܐ ܒܟܠܢܐ ܘܡܢܐ ܕܣܝܠܢܐ ܠܟܪܝܐ ܒܡܫܘܚܬܐ ܒܡܝܠܘ ܗ ܠܒ ٣٧ ، ܐܦ ܡܬܚܫܒܐ ܠܗ ܦܪܢܣܬܐ ܕܡܪܢܐ ܘܡܦܩܐ ܐܝܟܐ ܕܗܘܐ ܡܪܢܐ ܡܫܘܚܬܐ ܒܡܫܘܚܬܐ ܕܡܝܠܢܐ ܠܝܢܐ.

(ܐ) ܡܫܘܚܬܐ ܕܠܗܩܡܐ ܥܠ ܡܝܠܢܐ ܠܝܢܐ = ١٠ ܠܒ ٣٧

ܨ = ١٠ × ٠.٦

ܨ = ٦ ܡܬܪܐ/ܪܦ²

(ܒ) ܩ٢² = ܩ١² + ٢ ܘ ܓ

ܩ٢² = ܨܦܪܐ + ٢ × ٦ × ٣ = ٣٦

ܩ٢ = ٦ ܡ/ܪܦ

(ܓ) ܩ٢ = ܩ١ + ܓ ܘ

٦ = ܨܦܪܐ + ٦ ܘ

ܘ = ١ ܪܦܦܐ

(٢ — ٨) ܡܫܕܝܢܬܐ Projectiles

ܐ . ܠܘܩܡܐ ܪ̈ܦܐ ܘܡܦܩܬܐ

ܟܕ ܡܬܡܛܐ ܘܡܐ ܕܠܘܩܡܐ ܡܕܘܦܐ ܘܡܦܩܬܐ ܠܥܠ ܐܘ ܠܓܢܒܐ ܒܬܚܘܡܬܐ ܕܠܘܝܐ ܕܩܘܫܐ ܢܦܠܬܐ ܣܪܝܬܐ ܒܡܘܪܘܒܐ ܠܗ ܡܘܪܘܒܐ ܐܪܥܢܝܐ ܗ = -٨ .٩ ܡ / ܪܦ٢ ܘܐܘܠܨܢܐ ܕܠܘܩܡܐ ܠܟܠܗ ܢܘܩܙܬܐ ܡܬܢܛܪܐ ܒܗܝ ܗܘܝܐ ܐܦ ܡܘܠܘܬܗ ܠܗ ܕܟܕܪܗ ܠܢܘܩܙܬܐ ܕܦܬܠܘ ܪܘܦܐ ܡܢܗ ܒܗܝ ܡܘܠܘܬܐ ܕܪܦܝܗ ܒܡܘܠܐ ܘܗܦܟܐ ܠܗ ܒܝܘܡܐ ܘܝܬܒܐ ܕܡܘܠܬܐ ܕܠܘܩܡܐ ܠܢܘܩܙܬܐ ܒܟ ܠܟܠ ܗܘܝܐ ܠܒܝܬܐ ܕܟܕܪܗ ܠܢܘܩܙܬܐ ܕܪܦܝܗ.

ܓܘܒܝܐ

ܦܬܠܘ ܪܘܦܐ ܒܝܦܐ ܘܡܦܩܬܐ ܠܥܠ ܡܢ ܪܘܡܐ ܕܒܝܢܝܐ ܪ̈ܡܝܐ ܒܡܘܠܘܬܐ ܒܗܘܠܗ ٥ ܡܬܪܐ ܪܦ ܘܠܗ ܕܟܕܪܗ ܠܐ ܠܦܬܠܘ ܒܪܘܡܐ ܕܦܬܠܘ ܡܕܘܦܐ ܡܢܗ ܐܠܐ ܢܦܠܠܗ ܘܠܦܬܠܘ ܒܐܪܥܐ ܟܕ ܕܝܢܐ ܒܗܘܠܗ (٣) ܪܦ̈ܦܐ ܡܢ ܪܦܝܗ ܚܫܘܒ ܗ = - ١٠ ܡ / ܪܦ٢ ܚܫܘܒ ܡܐ ܕܐܬܐ :

ܐ . ܪܡܘܬܐ ܕܒܝܢܝܐ.

ܒ . ܡܘܠܘܬܐ ܕܒܝܦܐ ܠܗ ܕܟܕܪܗ ܠܢܘܩܙܬܐ ܕܪܦܝܗ.

ܓ . ܙܒܢܐ ܐܢܫܐ ܕܡܛܐ ܒܝܦܐ ܠܢܘܩܙܬܐ ܒܟ ܠܟܠ ܡܢ ܡܙܕܠܗ.

ܕ . ܡܫܘܚܬܐ ܒܟ ܪܟܬܐ ܡܛܝܬܗ ܒܝܦܐ ܡܢ ܥܓܠܐ ܕܐܪܥܐ

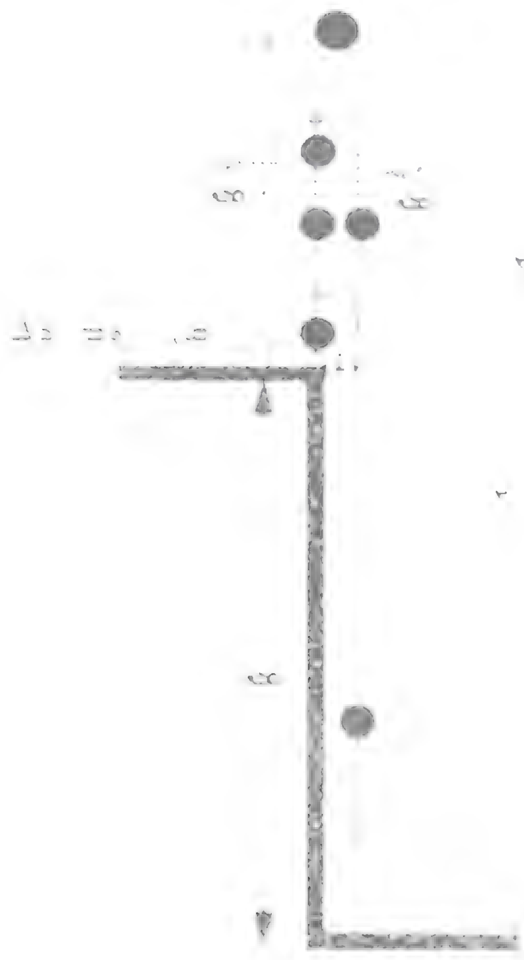
ܗ . ܡܘܠܘܬܐ ܕܠܒܘܫܬܐ ܕܒܝܦܐ ܒܥܓܠܐ ܕܐܪܥܐ.

ܥܢܝܐ

ܚܒܘܫ ܢܘܩܙܬܐ ܕܪܦܝܬܐ ܕܒܝܦܐ ܒܠܗ (ܐ) ܐܝܟ ܒܐܘܟܡܐ (٢ — ٨) ܘܪܡܘܬܐ ܕܒܝܢܝܐ (ܪ) ܡܬܪܐ

ܐ . ܡ ، ٠ = ١/٢ ܓ ܙ٢ = ٥ × ٣ − ١/٢ × ١٠ × ٩

ܪ = − ٣٠ ܡܝܛܪ̈ܐ ܡܢ ܢܘܩܙܬܐ ܕܫܘܪܝܐ. (ܪܡܙܐ ܠܬܚܬ ܒܗܝ ܝܠܗ ܒܝܘܬܐ-ܝ) ܘܗܘܝܐ ܪܚܩܘܬܐ ܕܒܢܝܢܐ ܡܢ ܫܛܚܐ ܕܐܪܥܐ + ٣٠ ܡܝܛܪ̈ܐ (ܒܗܝ ܝܠܗ ܒܝܘܬܐ +٢) ܠܦܘܬ ܫܛܚܐ ܕܐܪܥܐ



ܒ. ܩܘܒܐ (ܪ) ܠܗ ܕܒܕܪܬܐ ܕܠܘܝܬܐ ܠܢܘܩܙܬܐ ܕܪܡܘܬܐ ܣܦܝܩܐ.

$\text{ܡ}_{٢}^{٢} = \text{ܡ}_{١}^{٢} + ٢\,\text{ܪ}\,\text{ܓ}$

$\text{ܡ}_{٢}^{٢} = ٢٥ + ٢\,(-١٠)$. ܣܦܝܩܐ

$\text{ܡ}_{٢} = \pm ٥$ ܘܒܗܝ ܝܠܗ ܙܘܒ

ܠܚܕ ܝܠܗ. ٥ ܡ ܪܦ٢

ܓ. ܩܘܒܐ ܡܠܘܠܘܬܐ ܕܠܘܝܬܐ ܒܢܘܩܙܬܐ ܒ ܠܥܠ ܡܢ ܡܪܗܛܘ ܣܦܝܩܐ

$\text{ܡ}_{٢} = \text{ܡ}_{١} + \text{ܓ}\,\text{ܘ}$

$ܣܦܝܩܐ = ٥ + (-١٠)\,\text{ܘ}$

$\text{ܘ} = ٠٫٥$ ܪ̈ܦܦܐ

ܐܣܟܡܐ ٢ — ٨

ܕ. $\text{ܡ}_{٢}^{٢} = \text{ܡ}_{١}^{٢} + ٢\,\text{ܪ}\,\text{ܓ}$

ܪ = ١٫٢٥ ܡܝܛܪ̈ܐ ܡܘܣܝܘܬܐ ܕܠܘܝܬܐ ܡܢ ܢܘܩܙܬܐ ܐ

ܪ ܟܠܢܝܬܐ = ܪ + ܪܚܩܘܬܐ ܕܒܢܝܢܐ ܡܢ ܫܛܚܐ ܪ

٣٠ + ١٫٢٥ = ٣١٫٢٥ ܡܝܛܪ̈ܐ ܠܥܠ ܡܘܣܝܘܬܐ ܕܫܛܚܐ ܕܐܪܥܐ

$\text{ܡ}_{٢}^{٢} = \text{ܡ}_{١}^{٢} + ٢\,\text{ܪ}\,\text{ܓ}$

$\text{ܡ}_{٢} = ٢٥ + ٢(-١٠)(-٣٠)$

$\text{ܡ}_{٢} = ٦٢٥$

٢٥ ܘܥܕ ܙܘܥܐ ܕܦܠܛܘܬܐ ܒܡܫܚܐ ܕܠܥܠܐ ܒܙܘܥܐ (–٢)

$ܙ_٢ = -٢٥$ ܡ / ܪ

ܓ. ܫܕܝܐ ܡܪܘܡܐ ܠܦܬܐ ܡܢ ܐܘܦܩܐ

١. ܐܢܕ ܡܪܘܡܐ ܫܕܝܐ ܡܢ ܐܘܦܩܐ ܐ ܒܦܠܛܘܬܐ ܒܙܘܥܐ ܙ ܘܙܘܝܬܐ ܗ ܥܡ ܐܘܦܩܐ ܐܝܟ ܕܒܨܘܪܬܐ (٢ — ٩) ، ܘܡܢܗ ܕܒܬܪ ܟܠ ܡܢܘܬܐ ܕܫܕܝܐ ܚܕܐ ܕܙܒܢܐ ܘܕܦܠܛܘܬܐ ܠܗ ܡܢܬܐ ܒܡܕܝܢ ܕܐܝܟ ܡܪܘܡܐ ܐܘܦܩܝܐ ܙ ܓܝܒ ܗ ܡܝ ܐ ܡܢܘܬܐ ܕܢܦܠܬܐ ܒܥܢ ܡܪܘܡܐ ܐܘܦܩܝܐ ܕܡܢܡܪܡܘܬܐ ܐܕܟܐ ܒܐܪܐ ܦܫܛܐ ܐܠܐ ܡܢܬܐ ܠܗ ܡܫܚܬܐ ܕܡܪܘܡܐ ܙܩܝܦܐ ܕܦܠܛܘܬܐ ܘܠܗ (ܙ ܓܒ ܗ) ܐܦ ܡܢܬܐ ܠܗ ܡܫܚܬܐ ܕܡܬܚܬܐ ܙܩܝܦܬܐ ܕܡܬܡܫܚܬܐ ܒܟܠ ܙܒܢܐ ܠܐܡܪ ܡܢܘܬܐ ܕܢܦܠܬܐ ܚܕܐ ܕܫܕܝܐ ܘܟܠ ܕܗܘܐ ܡܢܬܐ ܠܗ ܫܚܝܢܬܐ ܕܡܬܚܬܐ ܒܥܢ ܠܒܪܘܬܐ ܕܡܬܠܗ ܡܪܡܝܬܐ ܠܡܪܘܡܐ ܒܕ $ܙ_٢ = ٠$ ܡܢ ܐܘܡܬܐ ܕܐܬܐ

$$ܙ_٢^{\,٢} = ܙ_١^{\,٢} + ٢\,ܓ\,ܪ$$

$$ܪܡ = \frac{(ܙ\ ܓܒ\ ܗ)^{٢}}{2\,ܓ}$$

ܨܘܪܬܐ (٢ — ٩)

ܘܟܕ ܙܒܢܐ ܕܡܫܬܪܝܠܗ ܡܪܘܩܐ ܠܡܛܝܬܐ ܠܥܘܡܩܐ ܝܬܝܪܐ ܗܘ ܦܠܓܐ ܕܙܒܢܐ ܕܐܝܬܗ ܠܢܚܘܬܗ ܠܥܘܡܩܐ ܬܚܬܝܐ ܒܝܬ ܐܘܦܩܐ ܒܗܘ ܠܪܘܚܩܗ ܒܗܘܢ ܕܐܝܬ ܐܝܟܢܐ ܐܘܦܩܝܐ ܐܒ = ܡ ܓܬܒ ܗ × ٢ ܙ

$$\text{ܐܒ} = \text{ܡ ܓܬܒ ܗ} \times ٢ \; \frac{(\text{ܡ٢ - ܡ١})}{\text{ܓ}}$$

$$\text{ܐܒ} = \text{ܡ ܓܬܒ ܗ} \; ٢ \; \frac{(\text{ܣܦܝܪܐ - ܡ ܓܒ ܗ})}{-\text{ܓ}}$$

$$\text{ܘܟܕ } ٢ \text{ ܓܒ ܗ ܓܬܒ ܗ} = \text{ܓܒ } ٢ \text{ ܗ}$$

$$\text{ܐܒ} = \frac{\text{ܡ٢ ܓܒ ٢ ܗ}}{\text{ܓ}} \quad \ldots\ldots \quad (٢ - ١٠)$$

ܚܠܦ ܗܠܝܢ ܡܢ ܦܘܫܩܐ (٢ ـ ١٠) ܕܪܘܚܩܐ ܒܝܬ ܬܪܝܢ ܐܘܦܩܝܐ ܠܡܪܘܩܐ ܗܘܐ ܐܝܟ ܕܗܘܐ ܙܘܝܬܐ ܕܪܡܝܗ ٤٥ (ܒܗܝ ܕܒ ܒܝܘܡܬܐ ܠ ܓܒ ٢ ܗ = ١ ، ٢ ܗ = ٩٠ ، ܗ = ٤٥).

ܡܛܠ ܕܐܗܐ ܐܝܟܐ ܐܝ. ܦܬܠܘ ܓܠܝܬܐ ܠܪܥܘܦܬܐ ܕܡܪܘܩܐ ܡܪܡܝܬܗ ܠܡܘܚܪܐ ܒܝܬ ܬܪܝܢ ܗܠܝܢ ܕܗܘܐ ܙܘܝܬܐ ܕܡܝܬܐ ܕܪܡܝܬܐ ٤٥ ܠܥܠ ܐܘܦܩܐ.

ܘܗܕܟܢܐ ܢܠܗ ܐܝܬܝܘܬܐ ܐܝ. ܒܦܬܠܘ ܬܪܝܢ ܕܪܘܡܐ ܐܘ ܬܪܝܢ ܕܝܘܡܬܐ ܓܘ ܓܠܝܬܐ ܕܙܒܢܐ ܘܡܫܕ. ܕܗܘܐ ܡܫܚܘܬܐ ܐܘܦܩܝܬܐ ܒܝܬ ܬܪܝܢ ܗܠܝܢ ܟܠܗ ܕܟܝܕ ܕܡܪܡܐ ܠܪܘܡܐ ܐܘ ܝܘܡܬܐ ܒܙܘܝܬܐ ܡܫܘܚܬܗ ٤٥ ܥܡ ܐܘܦܩܐ.

ܦܘܦܩܐ ١

ܦܬܠܘ ܪܘܦܬܐ ܡܪܡܝܬܐ ܐܘܦܩܝܐ ܒܡܠܘܠܘܬܐ ܗܘܠܗ ٣٠٠ ܡ/ܪ ܡܢ ܡܪܘܡܬܐ ܕܪܘܡܗ ٧٨،٤ ܡܬܪܐ ܡܢ ܫܛܚܐ ܕܐܪܥܐ. ܚܫܘܒ:

١ ـ ܙܒܢܐ ܕܡܛܝܬܐ ܕܡܪܡܝܬܐ ܠܐܪܥܐ.

٢ ـ ܪܘܚܩܐ ܕܡܪܡܝܬܐ.

٣ ـ ܒܝܫܐ ܡܠܘܠܘܬܐ ܒܡܛܝܬܐ ܡܪܡܝܬܐ ܒܐܪܥܐ؟

ܫܪܝܐ

$$١ .\ ܡ = \frac{١}{٢}\ ܓ\ ܙ^{٢}$$

$$-٧٨٫٤ = \frac{١}{٢} \times -٩٫٨ \times ܙ^{٢} \qquad ܙ^{٢} = ١٦$$

ܙ = ٤ ܪܦܦܐ ܙܒܢܐ ܕܡܛܠܬܐ ܕܡܪܡܝܬܐ ܠܐܪܥܐ

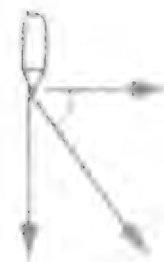
٢ . ܪܘ = ܫ ܠܟܠ ܗ · ܙ

ܪܘ = ٣٠٠ ܠܟܠ ܪܦܦܐ × ٤

ܪܘ = ٣٠٠ × ١ × ٤

ܪܘ = ١٢٠٠ ܡ ܪܘܚܐ ܕܡܪܡܝܬܐ





٣. ܣ١ = ܣ ܒܬܪ ܗ

- ٣٠٠ ܒܬܪ ܗܩܝܡܐ

= ٣٠٠ ، ١

= ٣٠٠ ܡ ܒܦ ܡܬܚܬܝܐ ܐܘܦܩܝܐ ܠܩܠܝܠܘܬܐ ܒܕܘܟܬܐ ܕܝܡܝܢܐ ܠܦܪܬܐ

ܣ٢ = ܣ١ + ܓ ܙ

ܣ٢ = ٠ + (−٩،٨) . ٤

ܣ٢ = − ٣٩،٢ ܡ ܒܦ ܡܬܚܬܝܐ ܙܩܝܦܐ ܠܩܠܝܠܘܬܐ ܕܡܬܚܬܝܬܐ ܒܕܘܟܬܐ

ܕܝܡܝܢܐ ܠܦܪܬܐ

$$ܣ = \sqrt{ܣ_١^٢ + ܣ_٢^٢}$$

$$ܣ = \sqrt{٣٠٠^٢ + (−٣٩،٢)^٢}$$

= ٣٠٢،٥ ܡ ܒܦ ܒܘܪܐ ܕܩܠܝܠܘܬܐ ܕܢܦܠܬܐ ܕܡܬܚܬܝܬܐ ܒܦܪܬܐ

$$ܛܠ ܗ = \frac{ܣ_٢}{ܣ_١}$$

$$ܛܠ ܗ = \frac{٣٩،٢}{٣٠٠}$$

ܛܠ ܗ = − ٠،١٣

ܗ = ٨ ܕܪܓܐ ܐܘܦܩܝܐ ܙܘܝܬܐ ܕܢܦܠܬܐ ܕܡܬܚܬܝܬܐ ܕܩܠܝܠܘܬܐ

ܡܬܠܐ ٢

ܦܪܚܠܗ ܩܘܦܬܐ ܡܪܡܝܬܐ ܒܡܠܘܠܘܬܐ ٢٠٠ ܡܝܬܪ̈ܐ \ ܪܦ ܘܒܙܘܝܬܐ ܕܪ̈ܓܝܬܐ ܥܡ ܐܘܦܩܐ ٣٧ ܓܒ ܐܘܦܩܐ ܐܝܟ ܕܡܚܘܝܐ (٢ — ١٠) ܘܐܢ ܗܘܐ

ܓܒ ٣٧ = $\frac{٣}{٥}$, ܓ = − ١٠ ܡ \ ܪܦ ٢ . ܐܫܟܚ :

ܐ - ܚܫܘܒ ܡܫܚܬܐ ܐܘܦܩܝܬܐ ܘܙܩܦܝܬܐ ܠܡܠܘܠܘܬܐ ܕܪܫܝܬܐ.

ܒ - ܡܠܘܠܘܬܐ ܕܡܪܡܝܬܐ ܘܙܘܥܗ ܒܬܪ ٥ ܪܦ ܡܢ ܪܫܝܬܗ.

ܓ - ܪܡܘܬܐ ܝܬܝܪܬܐ ܕܡܛܝܐܠܗ ܡܪܡܝܬܐ.

ܕ - ܡܬܚܐ ܐܘܦܩܝܐ ܕܡܪܡܝܬܐ.

ܫܪܝܐ :

ܐ - ܡܫܚܬܐ ܐܘܦܩܝܬܐ ܠܡܠܘܠܘܬܐ ܕܪܫܝܬܐ = ܡ ܓܒܓ ܗ

$$= ٢٠٠ \times \frac{٤}{٥}$$

= ١٦٠ ܡ / ܪܦ

ܡܫܚܬܐ ܙܩܦܝܬܐ ܕܡܠܘܠܘܬܐ ܕܪܫܝܬܐ = ܡ ܓܒ ܗ

$$= ٢٠٠ \times \frac{٣}{٥}$$

= ١٢٠ ܡ \ ܪܦ

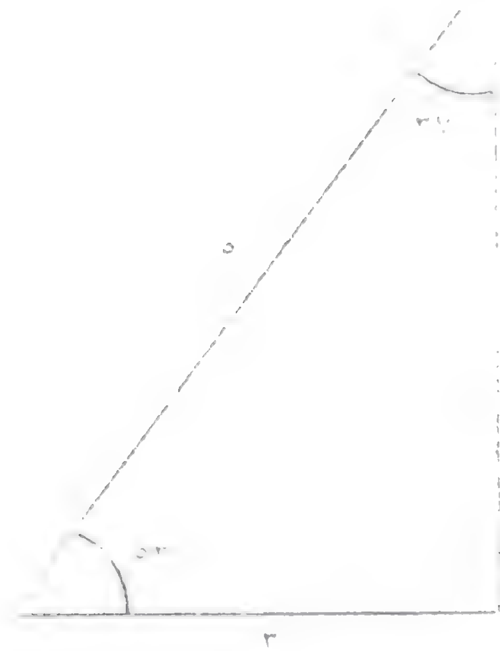


ܒ - ܡܫܚܬܐ ܙܩܦܝܬܐ ܠܡܠܘܠܘܬܐ ܕܪܫܝܬܐ ܒܬܪ (٥) ܪܦܦ̈ܐ = ܡ١ + ܓ ܙ

= ١٢٠ + (− ١٠ × ٥)

= ٧٠ ܡ ܒ ܪܦ

ܦܘܠܚܢܐ ܕܡܠܘܠܘܬܐ ܕܡܪܕܝܬܐ (ܒܬܪ ٥ ܪܦܦܐ) = $\sqrt{١٦٠^{٢} + ٧٠^{٢}}$



ܛܠ ܗ = ——— = ٠٫٤٣٧٥

ܗ = ٢٣٫٦٣ ܓܒ ܐܘܦܩܐ

ܓ. ܠܓܝܠ ܪܘܡܘܬܐ (ܪ) ܡܢ ܗܘܫܠܬܐ :

ܡ$_{٢}^{٢}$ = ܡ$_{١}^{٢}$ + ٢ ܪ ܓ

ܡܦܝܩܐ (ܡ ܓܒ ٣٧)^{٢} + ٢(−١٠)(ܪ)

= (١٢٠)^{٢} − ٢٠ ܪ

ܪ = ٧٢٠ ܡܝܬܪܐ

ܕ. ܪܘܚܩܐ ܐܘܦܩܝܐ ܐ ܒ = ܡ ܓܒ ܗ . ܙ ، ܟܕ ، ܝܠܗ ܙܒܢܐ ܕܡܦܠܚܢܘܬܐ ܕܡܪܕܝܬܐ ܠܟܠ ܡܫܝܚܘܬܐ

ܐ ܒ = ٢٠٠ . ——— . ٢ ((ܡ٢ ܡ١) / ܓ)

ܓܒ ܡ١ = ٢٠٠ ܓܒ ٣٧

= ٢٠٠ . (٤ / ٥) . ٢ ((ܡܦܝܩܐ . ٢٠٠) / −١٠)

ܐ ܒ = ٣٨٤٠ ܡܝܬܪܐ

(٢ — ٩) ܢܦܠܬܐ ܕܓܘܫܡܐ ܡܢ ܓܘ ܡܝܐ ܡܬܪܡܠܢܝܐ ܘܩܠܝܠܘܬܐ ܚܪܝܬܐ

ܡܕܡܠܘ ܘܡܫܘܚܬܐ ܕܙܪܘܙܬܐ ܕܡܫܘܕܪܘܬܐ ܐܪܥܢܝܐ ܝܠܗ. ٩٫٨ ܡ ܪܦ٢ ܟܡܘܬܐ ܡܢ ܟܠܚܕ ܕܐܪܥܐ ܘܠܘ ܓܫܡܐ ܟܡܟܟܝܘܬܐ ܕܦܘܫܐ ܘܟܠ ܚܠܐ ܐܚܪܢܐ ܡܟܟܝ ܥܠ ܓܘܫܡܐ ܢܦܠܢܐ ܚܕܪܘܬܐ ܓܘܫܡ ܡܢ ܚܠܐ ܕܡܬܦܬܐ ܕܐܪܥܐ. ܐܠܐ ܓܘܫܡܐ ܐܝܟ ܕܢܦܠ ܠܘ ܕܘܟܐ ܐܝܟ ܦܘܫܐ ܐܘ ܡܝܐ ܡܢ ܓܘ ܦܫܛܐ ܘܡܟܠܗ ܦܫ ܡܟܘܪܚ ܒܚܠܐ ܕܡܘܩܠܐ ܠܝܘܩܐ ܕܪܘܚܐ. ܡܢܗ ܚܠܐ ܕܡܪܚܩܘܬܐ ܕܪܘܩܐ ܠܗ ܘܚܠܐ ܕܚܣܝܬܐ ܕܕܘܩܐ ܠܚܕܗ ܡܢܐ ܕܡܬܟܟܒ ܠܡܟܝܪܬܐ ܕܡܫܘܕܪܢܗ ܘܐܗܐ ܟܘܪܝܐ ܐܝܟ ܟܡܝܕܬܐ ܕܩܠܝܠܘܬܐ ܕܢܦܠܬܐ ܕܓܘܫܡܐ ܘܐ. ܦܟܠܗ ܐܢܐ ܚܠܐ ܡܬܪܘܡܢܝܐ ܬܘܢܐ ܠܘܩܒܠ ܕܓܘܫܡܐ ܢܦܠܢܐ ܐܡܠܘ ܓܘܫܡܐ ܥܠ ܢܦܠܬܐ ܒܩܠܝܠܘܬܐ ܡܫܘܚܬܐ ܦܫܐ ܡܪܝܬܐ ܐܗܐ ܩܠܝܠܘܬܐ ܚܪܝܬܐ Terminal Velocity ܠܐܗܐ ܓܘܫܡܐ ܘܓܘ ܢܦܠܬܐ ܕܡܬܠܠܢܐ ܟܐܪܐ ܘܚܕܐ ܡܠܘܠܘܬܗ ܟܡܐ ܕܢܦܠܬܗ ܐܠܐ ܠܘ ܦܫܝܬܐ ܕܡܬܠܠܗ ܘܚܕ ܟܘܪܝܐ ܕܦܘܫܐ ܠܘܟܘ ܘܟܝܪ ܡܫܘܕܪܐ ܕܡܬܠܠܢܐ. ܐܦ ܘܚܕ ܟܘܪܝܐ ܕܦܘܫܐ ܐܠܗܐ ܘܡܟܐ ܟܡܝܕܬܐ ܕܡܠܘܠܘܬܐ ܕܢܦܠܬܗ ܘܐ. ܦܟܠܗ ܟܡܢܬܐ ܕܡܡܫܐ ܕܡܬܠܠܢܐ ܘܡܬܠܠܗ ܬܘܢܐ ܒܟܘܢܢܐ ܕܟܘܪܝܐ ܕܦܘܫܐ ܘܚܠܐ ܕܡܪܚܩܘܬܐ ܕܦܘܫܐ ܠܗ ܘܢܛܠܗ ܐܡܢ ܡܬܠܠܢܐ ܥܠ ܢܦܠܬܐ ܒܡܠܘܠܘܬܐ ܡܫܘܚܬܐ ܠܘ ܡܠܘܠܘܬܐ ܚܪܝܬܐ ܠܢܦܠܬܗ ܘܗܘܝ ܟܘܡܪܐ ܕܡܬܠܠܢܐ ܥܠ ܚܣܝܬܐ ܟܐܪܐ ܘܡܟܝܟܘܬܐ ܕܦܪܨܘܦܐ ܕܡܬܠܠܐ ܟܕܝ ܟܡܘܕܐ ܓܡܘܪܐ ܠܘ ܡܟܝܪܬܐ ܕܩܘܠܐ ܡܢܢܢܐ ܠܡܠܘܠܘܬܐ ܚܪܝܬܐ ܘܐܗܐ ܠܡܟܝܪܬܐ ܕܟܘܢܢܐ ܕܓܘܦܐ ܒܟܠܚܕ ܕܐܪܥܐ ܘܠܫܡܐ ܝܠܗ ܐܗܐ ܟܕܪܐ ܟܠ ܢܛܘܦܬܐ ܕܡܬܪܐ ܘܟܕܪܐ.

ܫܘܐܠ̈ܐ

ܫ ١ : ܓܒܝ ܠܦܘ̈ܢܝܐ ܬܪ̈ܝܨܐ ܒܟܠ ܚܕ ܡܢ ܗ̈ܠܝܢ ܕܐܬܝܢ :

ܐ. ܬܪ̈ܝ ܓܘܫ̈ܡܐ ܐ ܘ ܒ ܟܠ ܚܕ ܡܢܗܘܢ ܕܡܘܬܐ ܦܫܠܗ ܕܦܫܛܐ (ܐ) ܐܘܦܣܢܝܬ ܘܒܕܩܩ̈ܐ ܒܬܪܗ ܢܦܠܠܗ (ܒ) :

(١) ܓܘܫܡܐ (ܐ) ܡܛܝܢ̈ܐ ܠܐܪ̈ܥܐ ܡܕܡܐܝܬ

(٢) ܓܘܫܡܐ (ܐ) ܡܠܘܠܘܬܗ ܒܝܕ ܪ̈ܒܬܐ ܡܢܗ ܒܕܩܩ̈ܐ ܕܡܛܝܢܘܬܗ ܠܐܪ̈ܥܐ

(٣) ܓܘܫܡܐ (ܒ) ܡܛܝܢ̈ܐ ܠܐܪ̈ܥܐ ܡܕܡܐܝܬ.

(٤) ܓܘܫܡܐ (ܒ) ܡܠܘܠܘܬܗ ܒܝܕ ܪ̈ܒܬܐ ܡܢܗ ܒܕܩܩ̈ܐ ܕܡܛܝܢܘܬܗ ܠܐܪ̈ܥܐ

ܒ. ܪ̈ܒܥܐ ܕܕܪ̈ܓܬܐ ܡܛܝܢ ܕܣܘܡܐ ١٢ ܣܡ ܒܡܫܚܐ ٤٠ ܡܛܝܢܐ ܘܡܥܪܟܐ ܕܐܘܠܘܬܗ ܒܕܪ̈ܓܬܗ ܗܝܢܘ :

١) ٠,٣ ܣܡ ܡܪ　　　　٢) ١٨ ܣܡ ܡܪ

٣) ٨ ܣܡ ܡܪ　　　　٤) ٤٨ ܣܡ ܡܪ

ܓ. ܙܒܢܐ ܕܡܬܒܥܐ ܠܪ̈ܕܝܐ ܙܒܢܐ ܒܡܘܪ̈ܒܐ ٢ ܡ / ܪܦ² ܠܫܘܠܦܐ ܕܡܠܘܠܘܬܗ ܡܢ ١٠ ܡ / ܪܦ ܠ ٣٠ ܡ / ܪܦ ܗܝܘ :

١) ٣٠ ܪܦ　　　　٢) ٢٠ ܪܦ

٣) ١٠ ܪܦ　　　　٤) ٤٠ ܪܦ

ܕ. ܚܫܒܬܐ ܗܝ ܓܘܫܡܐ ٢٠ ܪܦܦ̈ܐ ܘܣܘܡܐ ٤٠٠ ܡܬܪܐ ܕܪܗܛܐ ܡܢ ܐܪܥܐ ܕܒܗ ܓܘܫܡܐ ܐܝܟ ܕܒܪ̈ܝܐ ܒܘܠܝܐ ܡܢ ܝܠܘܦܬܐ ܘܡܘܬܒܐ ܕܡܠܘܠܘܬܗ ܒܕܩܩ̈ܐ ܕܡܛܝܢܘܬܗ ܠܐܪ̈ܥܐ :

١) ٢٠ ܡ / ܪܦ　　　　٣) ٤٠ ܡ / ܪܦ

٢) ٣٢ ܡ / ܪܦ　　　　٤) ٨٠ ܡ / ܪܦ

ܗ - ܦܫܠܗ ܪܗܛܐ ܓܘܫܡܐ ܒܡܘܫܚܬܐ ٣٠ ܟܓܡ ܐܘܣܝܐ ܘܡܠܘܠܘܬܐ ٣ ܡ / ܪܦ ܘܒܬܪ $\frac{١}{٢}$ ܪܦܦ̈ܐ ܦܫ ܡܪܒܒܐ ܐܘܣܝܐ ܠܡܠܘܠܘܬܗ :

١) ١.٥ ܡ/ܪܦ ٢) ٤.٩ ܡ/ܪܦ
٣) ٢.٦ ܡ/ܪܦ ٤) ٥.٥ ܡ/ܪܦ

ܗ - ܒܟܪܝܟܘܬܐ ܕܦܘܫܐ ܘܡܘܙܢܐ ܕܦܘܫܐ ܗܘܐ ܠܡܪܟܒܬܐ ܡܓܫܐ ܒܝܬ ܪܓܠܐ
ܘܦܫܛܐ ܠܗ ܪܦܬܗ ܒܙܘܝܬܐ ܥܡ ܐܪܥܐ ܡܫܘܚܬܗ:
١) ٣٠° ٢) ٦٠°
٣) ٤٥° ٤) ܟܠ ܐܝܕܐ ܥܠ ܡܠܘܠܘܬܐ ܒܪܘܝܬܐ ܕܡܪܟܒܬܐ

ܘ - ܡܫܪܘܝܐ ܕܓܠܦܐ ܡܪܘܦܐ ܪܟܝܟ:
(١) ܒܝܬ ܪܓܠܐ ܡܢ ܫܪܘܝܗ ܒܐܝܟܢܝܘܬܐ ܕܫܒܬܐ
(٢) ܩܘܡܐ ܒܟܪܘܟ ܐܝܟܢܝܘܬܐ ܕܦܠܛܬܐ ܘܫܒܬܐ
(٣) ܒܝܬ ܙܒܢܐ ܡܢ ܫܪܘܝܗ ܒܐܝܟܢܝܘܬܐ ܕܫܒܬܐ
(٤) ܡܦܝܫܐ ܠܗ ܡܬܚܡܗ ܠܪܡܘܬܐ ܒܝܬ ܪܓܠܐ.

ܚ - ܠܘܚܬܐ ܦܫܠܗ ܪܘܦܬܐ ܘܦܫܛܐ ܘܐܣܪܬܐ ܦܫܠܗ ܡܬܢܦܠܬܐ ܡܢ
ܪܡܘܬܐ ܒܢܐܗ ܒܪܦܦܐ ܒܢܐܗ ܒܬܘ:
(١) ܠܘܚܬܐ ܡܕܡܝܬܐ ܡܛܝܐ ܠܐܪܥܐ ܩܕܡܝܬ
(٢) ܠܘܚܬܐ ܗܪܝܬܐ ܡܛܝܐ ܠܐܪܥܐ ܩܕܡܝܬ
(٣) ܡܛܝܢ ܥܡ ܚܕܕܐ
(٤) ܦܠܝܫ ܡܬܡܘܬܗ ܠܡܦܪܫ

ܛ - ܗܕܐ ܠܘܚܬܐ ܦܫܠܗ ܪܘܦܬܐ ܙܒܢ ܠܟܠ ܐܢܫ ܕܐܘܠܘܬܐ ܕܡܕܡܝܬܐ
ܚܦܝܦ ܕܐܘܠܘܬܐ ܕܗܪܝܬܐ. ܪܡܘܬܐ ܕܡܛܝܐܠܗ ܠܘܚܬܐ ܡܕܡܝܬܐ ܩܘܡܐ

(١) $\sqrt{٢}$ ܡܢ ܪܡܘܬܐ ܕܗܪܝܬܐ
(٢) ܚܦܝܦ ܕܪܡܘܬܐ ܕܗܪܝܬܐ
(٣) ܐܪܒܥܐ ܓܗܐ ܕܪܡܘܬܐ ܕܗܪܝܬܐ
(٤) ٨ ܓܗܐ ܕܪܡܘܬܐ ܕܗܪܝܬܐ
ܚܫܘܒ ܓ = ٩.٨ ܡ/ܪܦ٢

ܫ ٢ : ܐܢ̈ܐ ܫܢ̈ܝܐ ܐܡܪܐ ܐܡܬܢܝܬ (ܕܐܘܪܟܘܬܐ ܕܡܪܒܥܐ ܒܝܢ ܬܪ̈ܝ ܢܘܩܙ̈ܐ
ܝܠܗ ܒܘܢܐ ܡܢܝܢܐ ܠܡܝܬܪ̈ܐ ܕܩܠܝܠܘܬܗ ܒܝܢ ܐܢ̈ܐ ܬܪ̈ܝ ܢܘܩܙ̈ܐ ، ܐܝܟܢܐ ܟܐܬܐ
ܟܡܘܦܩܐ ܢܟܡ ܪܘܫܡܐ.

ܫ ٣ : ܐܢ̈ܐ ܬܠܡܝܕ ܢܡܘܦܩܐ ܕܡܫܚܬܐ ܐܘ ܠܘܦܬܐ ܕܬܪܬܐ ܠܡܪܘܝܐ
ܕܡܪܒܥܐ ܚܕܐ ܕܦܬܝܐ ، ܦܝܫ ܟܐܬܐ

ܫ ٤ : ܘܒܟܠܗ ܡܪܒܥܐ ܡܢ ܚܠܘܬܐ ܒܫܘܪܝܐ ܡܫܟܚܐ ܒܘܢܠܗ ٢ ܡ
ܕܩ٢ ܐܬܒܥ :
ܐ. ܩܠܝܠܘܬܗ ܕܝܢܝܬܐ ܒܬܪ (٥) ܕܩܝ̈ܩܐ ܡܢ ܫܘܪܝܐ ܕܪܗܛܗ.
ܒ. ܡܫܚܬܐ ܕܩܠܝܠܘܬܗ ܒܡܫܚܐ (٥) ܕܩܝ̈ܩܐ ܩܕܡܝ̈ܐ ܡܢ ܪܗܛܗ.
ܓ. ܡܨܥܝܘܬܐ ܩܠܝܠܘܬܐ ܒܡܫܚܐ ܕܚܡܫܐ ܕܩܝ̈ܩܐ ܡܢ ܪܗܛܗ.
ܕ. ܡܨܥܝܘܬܐ ܩܠܝܠܘܬܐ ܒܡܫܚܐ ܒܕܩܝ̈ܩܐ ܐܚܪ̈ܢܐ ܡܢ ܪܗܛܗ

ܦ : ١٠ ܡ/ܕܩ ، ٥ ܡ/ܕܩ ، ٢٥ ܡܝܬܪ̈ܐ ، ٩ ܡܝܬܪ̈ܐ (ܒܡܘܬܐ ܕܡܫܘܚܬܗ

ܫ ٥ : ܬܪܟܠܗ ܡܪܒܥܐ ܠܟܠ ܕܝܢܫܐ ܝܘܢܐ ܒܫܒܥܐ ܒܫܘܪܝܐ ܡܫܟܚܐ
ܘܡܫܟܠܗ (٩) ܡܝܬܪ̈ܐ ܒܡܫܚܐ ܕܬܠܬܐ ܕܩܝ̈ܩܐ ܩܕܡܝ̈ܐ ܡܢ ܪܗܛܗ ܡܢ
ܫܠܘܬܐ. ܟܡܐ ܝܠܗ ܪܒܐ ܐܝܟܢܐ ܬܪܬܐ ܡܢ ܫܘܪܝܐ ܕܪܗܛܗ ܕܡܛܐ
ܠܩܠܝܠܘܬܐ ٢٤ ܡ/ܕܩ؟

ܦ : ١٢ ܕܩܝ̈ܩܐ

ܫ ٦ : ܦܬܠܗ ܪܘܩܐ ܠܘܬܐ ܘܡܩܕܡ ܠܟܠ ܐܝܟܐ ܕܡܛܐ ܠܬܪܬ ܪܫܘܬܐ ܠܗ
ܘܒܘܢܠܗ ١٢٢٥٠ ܡܝܬܪ̈ܐ (ܒܚܘܡ ܠܟܘܪܐ ܕܦܘܫܐ) ܚܙܝ :
ܐ. ܟܡܐ ܝܠܗ ܒܘܢܐ ܕܩܠܝܠܘܬܐ ܬܪܘܡܬܐ ܠܪܩܥܬܐ ܕܠܘܬܐ.
ܒ. ܪܒܐ ܐܝܟܢܐ ܕܒܝܬ ܠܘܬܐ ܠܬܘܩܐ ܕܪܩܥܗ.
ܓ. ܐܝܟܢ ܗܘܐ ܢܟܠ ܪܫܘܬܐ ٧٨٤٠ ܡܝܬܪ̈ܐ

ܦ : ٤٩٠ ܡ/ܕܩ ، ١٠٠ ܕܩ ، (٢٠ ، ٨٠) ܕܩܝ̈ܩܐ

ܫ ٧ : ܡܪܒܥܐ ܪܗܛ ܥܠ ܚܘܕܪܐ ܐ ܒ ܓ ܕ ܐ ܦܠܛܐ ܕܡܫܚܬܗ ٥ ܡ
ܒܩܠܝܠܘܬܐ ܩܒܝܥܬܐ ܘܩܡ ܚܕܐ ܕܘܪܬܐ ܒܕܩܝ̈ܩܐ. ܟܡܐ ܝܠܗ ܫܘܕܪܗ ܠܗ
ܫܢܝܬܗ :

١ . ܡܢ ܐ ܠ ܒ   ٢ . ܡܢ ܒ ܠ ܓ

٣ . ܡܢ ܐ ܠ ܒ   ٤ . ܕܘܪܬܐ ܠܡܫܒܬܐ؟

ܦ : (١٨٠ ܡ/ܪܒ² ܦܬܝܘܬܐ ܕܩܝܡܬܐ ܡܪܒܥܝܬܐ ، ١٨٠ ܡ/ܪܒ² ܦܬܝܘܬܐ ܕܓܪܒܝܐ ܡܪܒܥܝܬܐ ، ١٣٠ ܡ/ܪܒ² ܠܡܪܒܥܝܬܐ . ܗܟܝܠ)

ܬ ٨ : ܦܠܓܠܗ ܠܡܪܒܥܐ ܒܡܠܘܠܘܬܐ ܬܪܘܝܬܐ ܒܦܬܝܘܗ (٨) ܡܝܬܪ̈ܐ ܪܒ ܘܒܡܘܪܝܬܐ ܡܫܚܬܐ ܘܡܫܟܚܠܗ ٦٤٠ ܡܝܬܪ̈ܐ ܠܗ (٤٠) ܪܦܦ̈ܐ ܡܢ ܬܘܪܬܐ ܕܙܘܥܗ . ܐܬܝܢ :

ܐ . ܡܢܐ ܕܡܠܘܠܘܬܗ ܒܡܫܚܐ ܐܢ ٤٠ ܪܦܦ̈ܐ؟

ܒ . ܡܠܘܠܘܬܗ ܬܘܠܫܬܐ ܟܡܐ (٤٠) ܪܦܦ̈ܐ ܡܢ ܐܘܪܟܘܬܗ .

ܓ . ܡܫܘܚܬܐ ܕܡܪܒܥܐ .

ܦ : ١٦ ܡ ܪܒ . ٢٤ ܡ/ܪܒ . ٤٠٠ ܪܒܪ²

ܬ ٩ : ܢܦܠܠܗ ܠܡܪܒܥܐ ܡܢ ܟܠܦܢܐ ܐܝܟ ܕܗܘܐ ܟܠ ܪܡܘܬܐ (٤١٠) ܡܝܬܪܐ ܡܢ ܬܚܘܬ ܕܐܪܥܐ ܐ . ܟܠܦܢܐ ܪܝܡ ܗܘܐ ܠܟܠ ܒܡܠܘܠܘܬܐ ٨ ܡ ܪܒ ܐܝܟ ܒܡܫܚܐ ܠܡܪܒܥܐ ܠܬܚܘܬ ܕܐܪܥܐ؟

ܦ : ١٠ ܪܦܦ̈ܐ

ܬ ١٠ : ܙܒܢܠܗ ܡܠܘܠܘܬܐ ܕܐܪܥܬܐ ܡܢ ٨ ܡ ܪܒ ܥܠ ٣٢ ܡ/ܪܒ ܘܐܘܐ ܒܡܫܚܐ ܕܡܫܟܚܗ ܡܙܘܢܬܐ ܒܦܢܝܬܗ (٨٠) ܡܝܬܪܐ ܒܡܫܘܚܬܐ ܡܫܟܚܬܐ

ܐ . ܟܡܐ ܐܠܗ ܒܦܢܝܬܐ ܕܐܘܐ ܡܫܘܚܬܐ؟

ܒ . ܟܡܐ ܐܠܗ ܙܒܢܐ ܡܫܟܚܬܐ ܠܐܘܐ ܘܡܟܐ؟

ܦ : ٦ ܡ/ܪܒ² . ٤ ܪܦܦ̈ܐ

ܬ ١١ : ܦܫܠܗ ܦܫܡܬܐ ܡܢܦܩܬܐ ܒܡܠܘܠܘܬܐ ٧٢٠ ܒܡ ܬܠܬܐ ܟܠ ܫܢܬܐ ܒܙܘܥܬܐ (٥٣) ܒܡ ܐܘܦܝܬܐ ܐܝܟ ܕܗܘܐ ܟܠ ܪܡܘܬܐ ٦٦٠ ܡ ܡܢ ܬܚܘܬ ܕܐܪܥܐ . ܟܠ ܐܝܡܬܐ ܡܫܚܐ ܡܢ ܫܢܬܐ ܩܠܐ ܕܪܦܦܐ ܒܡܫܚܬܗ ܕܡܫܚܐ ܠܫܢܬܐ؟

ܫܬܝܢ ܗ = ١٠ ܡ/ܪܒ²

ܫܬܝܢ ܒܡܫܚܬܐ ܕܡܫܘܚܬܐ ܐܪܥܬܐ = ١٠ ܡ ܪܒ² ܒܬܪܥܬܐ ܕܡܘܐܠܐ ܕܐܪܥܐ

ܬ ١٢ : ܡܢܝܢܬܐ ܪܦܦܐ ܡܪܡܫܬܐ ܠܡܫܚܐ ܒܬ ܪܒܐ ܒܡܠܘܠܘܬܐ ܦܘܡܫܬܐ ܒܦܢܝܬܗ (٣٠٠ ܡ/ܪܒ) ܐ . ܒܡܠܘܠܘܬܐ ܠܙܘܥܐ ܕܦܘܫܐ ܫܬܝܢ :

(١) ܙܒܢܐ ܕܦܪܝܫܬܐ ܕܡܪܡܫܬܐ .

(٢) ܪܗܘܛܐ ܚܕ ܪܟܒܐ ܡܬܢܝܠܗ.

(٣) ܡܠܘܠܘܬܐ ܕܫܒܝܠܐ ܕܡܪܕܘܬܐ ܒܐܪܥܐ.

ܦ : ٦٠ ܕܩ . ٤٥٠٠ ܡ . ٣٠٠ / ٢ ܡ ܕܩ

ܬ ١٣ : ܦܬܚܠܗ ܪܦܩܐ ܠܗܘܡܐ ܐܘܛܘܡܒܝܠ ܡܢ ܡܕܝܢܬܐ ܕܟܘܪܟܐ ܪܗܘܛܗ ٨٠ ܡ ܒܫ. ܟܝܦܬܚܠܗ ܒܐܪܟܐ ܟܝܢ ܢܘܗܪܐ ܟܠܟܐ، ١٦٠ ܡ، ܐܘܛܘܡܒܝܠ ܡܢ ܐܬܐ ܕܟܘܪܟܐ ܗܡܙ ܠܗ

(١) ܙܒܢܐ ܕܦܬܚܬܐ ܕܠܗܘܡܐ ܡܘܢܟܢܐ.

(٢) ܡܠܘܠܘܬܐ ܕܪܦܩܬܐ ܕܠܗܘܡܐ.

ܦ : ٤ ܕܩ ، ٤٠ ܡ \ ܕܩ

ܬ ١٤ : ܦܬܚܠܗ ܡܪܘܦܩܐ ܠܗܘܡܐ ܒܡܠܘܠܘܬܐ ، ٥٠ ܡ ܕܩ ، ܒܪܘܗܛܐ (٥٣) ܠܟܠ ܐܘܦܡܐ ܡܢ ܪܗܘܛܐ ܟܠܐ . ١٠٠ ܡ ، ܡܢ ܝܘܡܢܐ ܕܐܪܟܐ ܝܐ.

ܒܫܠܡܘܬ ܠܘܢܐ ܕܦܘܫܐ ܗܡܙ ܠܗ :

(١) ܙܒܢܐ ܕܦܬܚܬܐ ܕܠܗܘܡܐ ܡܘܢܟܢܐ .

(٢) ܡܕܫܐ ܐܘܦܡܐ ܕܡܬܟܠܠܗ .

ܦ : ١٠ ܕܩ ، ٣٠٠ ܡ

ܬ ١٥ : ܡܕܡܬܐ ܪܦܩܐ ܡܪܡܝܬܐ ܒܘܢܝܬܐ ٣٠ ܠܟܠ ܐܘܦܡܐ ܒܡܠܘܠܘܬܐ ܦܘܬܚܬܐ ٢٠٠ ܡ ܕܩ ܟܠ ܪܗܘܛܐ ܕܫܢܬܐ ܒܝܘܡܐ ܒܡܠܘܠܘܬܐ ܡܬܦܬܚܬܐ ܒܡܬܠܗ ١٥ ܡ ܕܩ ܗܡܙ ܠܗ ܡܘܢܟܘܬܐ ܟܡ ܡܕܡܬܐ ܘܪܗܘܛܐ ܒܪܦܩܐ ܕܪܦܬܐ ܕܡܪܡܝܬܐ ܐܝܟ ܕܟܪܝܐ ܡܕܡܬܐ ܡܫܚܬܐ ܪܟܝܒܬܐ ܒܗ .

ܦ : ٣٧٠٠ ܡ

ܦܣܘܩܐ ܬܠܝܬܝܐ

٣ — ١ ܚܝܠܐ

٣ — ٢ ܐܕܫܐ ܕܚܝܠܐ

٣ — ٣ ܥܠܬܐ ܕܚܝܠܐ

٣ — ٤ ܚܕܝܘܬܐ ܕܥܠܬܐ ܕܚܝܠܐ

٣ — ٥ ܦܘܠܚܢܐ ܕܚܝܠܐ ܬܩܝܠܐ
ܥܠ ܓܘܫܡܐ

٣ — ٦ ܚܒܨܬܐ

٣ — ٧ ܐܕܫܐ ܕܚܒܨܬܐ

٣ — ٨ ܡܫܘܚܬܐ ܕܚܒܨܬܐ

٣ — ٩ ܚܘܡܟܢܐ

٣ — ١٠ ܓܘܢܒ ܢܘܠܐ

٣ — ١١ ܡܘܪܘܠܢܐ

٣ — ١٢ ܡܫܠܡܢܘܬܐ ܕܚܘܡܪܐ ܕܠܘܓܡܐ

ܒܪܝܫ ܬܠܘܦܐ ܗܘܦܠܐ
ܕܚܝܠܐ ܘܦܠܚ ܥܡܗ ܙܘܥܐ
ܘܐܢܟܝܘܬܐ ܕܥܠܬܗ ܘܐܕܫܘܗܝ
ܘܐܡܪ ܥܠ ܗܕܐ ܚܝܠܐ ܐܝܟܢܐ ܠܘ
ܥܢܐ ܥܠܘܗܝ ܚܝܠܐ ܕܚܒܨܬܐ
ܘܬܘܦܩܬܐ. ܘܡܬܚܕܝܘܬܐ ܕܚܝܠܐ
ܥܠ ܠܘܓܡܐ ܘܚܘܡܟܢܘܗܝ

(٣ — ١) ܚܝܠܐ Force

ܡܢ ܡܫܬܥܠܝܢܘܬܐ ܐܢܫܝܐ ܟܘܠܝܘܡ ܦܝܫܐ ܝܠܗ ܣܘܟܠܐ ܕܚܝܠܐ. ܘܚܝܠܐ ܟܫܠܦ ܐܘ ܓܪܫ ܕܟܫܠܦ ܠܐܬܢܘܬܐ ܘܫܘܢܝܐ ܕܓܘܫܡܐ ܘܦܫܛ ܠܒܠܬܐ ܘܡܬܠܝܐ ܠܡܘܕܥܢܐ ܡܢܗ ܘܟܫܠܦ ܙܘܥܗ ܘܐܝܟ ܗܕܐ ܚܝܠܐ ܕܡܦܩܬܐ ܐܘ ܢܦܩܬܐ ܟܡ ܟܣܘܝܬܐ ܕܣܘܪܟܐ ܘܡܘܦܠܐ ܡܟܢܝܫܐ ܐܦ ܐܝܟ ܗܕܐ ܚܝܠܐ ܕܡܦܩܬܐ ܘܢܦܩܬܐ ܟܡ ܣܡܝܟܬܐ ܕܥܠ ܗܘܠܐ ܕܟܬܡܠܗ ܒܐܝܬܝܘܬܗ ܟܢܝܬܐ ܘܐܝܟ ܗܕܐ ܚܝܠܐ ܒܪܝܐ ܡܢ ܦܡܢܝܬܐ ܢܘܗܪܐ ܐܘ ܦܡܢܝܬܐ ܕܟܪܘܒܐ ܐܘ ܕܡܢܥܝܐ. ܟܠ ܐܢܐ ܘܟܪܝܗ ܕܐܢܐ ܡܣܒܪܠܝ ܠܡܣܒܪܬܐ ܕܚܝܠܐ ܝܠܗ ܟܠ ܡܟܢܝܫܢܐ ܕܟܫܠܦ ܐܘ ܓܪܫ ܠܐܬܢܘܬܐ ܘܫܘܢܝܐ ܐܘ ܐܫܬܡܥܐ ܐܘ ܚܪܝܬܐ ܕܥܠ ܗܘܠܐ ܐܘ ܥܠ ܓܘܫܡܐ".

(٣ — ٢) ܐܕܫܐ ܕܚܝܠܐ

ܠܐ ܝܢܗ ܟܠܗ ܚܝܠܐ ܡܢ ܚܕ ܐܕܫܐ ܘܐܝܟ ܗܕܐ ܚܝܠܐ ܡܟܢܝܫܐ ܠܓܘܫܡܐ ܗܟܝܒܝ ܟܠܗ ܚܕ ܕܟܐ ܐܝܟ ܚܝܠܐ ܕܟܠܝܢܐܘ ܐܒܕܐ ܥܠ ܡܣܘܬܐ ܟܡ ܐܘܬܢ ܕܡܫܢ ܕܐܢܐ ܘܚܝܠܐ ܕܟܠܝܢܐܘ ܟܫܠܐ ܥܠ ܐܒܕܐ ܕܡܢܐ ܕܚܟܝܠܗ ܘܐܝܟ ܗܕܐ ܐܕܫܐ ܐܚܪܢܐ ܡܢ ܚܝܠܐ ܗܟܝܒܝ ܥܠ ܓܘܫܡܐ ܡܢ ܒܘܫܐ ܐܝܟ ܚܝܠܐ ܕܡܦܩܬܐ ܕܐܪܥܐ ܠܓܘܫܡܐ ܘܚܝܠܐ ܕܡܦܩܬܐ ܐܘ ܢܦܩܬܐ ܟܡ ܣܘܪܟܐ ܡܟܢܝܫܐ ܘܓܘܢܝܐ ܚܝܠܐ ܘܗܕܐ ܕܗܘܐ ܐܕܫܘ. ܒܪܝܐ ܕܗܘܝ ܚܝܠܐ ܓܘܝܐ internal forces ܐܝܟ ܚܝܠܐ ܕܗܟܝܒܝ ܟܠܗ ܗܘܝܐ ܡܢ ܓܘܡܒܪܬܐ ܕܓܘܫܡܐ ܕܒܢܝܢܐ ܡܫܟܠܠܐ ܘܗܕܐ ܕܡܬܘܡܕܘ ܡܢ ܬܘܦܣܐ ܘܐܝܟ ܚܝܠܐ ܕܟܠܝܢܐܘ ܦܪܙܘܦܐ ܝܬܝܒܐ ܬܘ ܒܝܬܐ ܡܟܪܘܟܐ ܘܟܦܬܘ ܠܡܕܡܐ ܘܚܝܠܐ ܕܪܒܝܬܐ ܘܕܟܝܬܐ ܟܡ ܕܡܬܐ ܕܗܘܠܐ ܘܚܝܠܐ ܗܟܝܒܝ ܟܠܒܪܐ ܐܫܒܪܐ ܟܡ ܗܪܝ ܓܘܫܡܐ ܦܪܝܫܐ.

(٣ — ٣) ܟܝܠܬܐ ܕܚܝܠܐ

ܐܝܟ ܕܐܬܐܠܗ ܓܘ ܡܢܗ، ܗܘܝ ܕܟܝܒܪܠܗ ܟܡ ܓܘ ܕܪܫܐ، ܟܝܒܪܬܐ ܕܡܪܕܝܬܐ ܕܐܬܠܐ ܝܘܦܪܐ ܝܠܘܦܢܐ ܦܫܛ ܗܐܕܝܟ ܟܡ ܟܝܠܬܐ ܕܚܝܠܐ ܓܪܫܢܐ ܠܚܕ ܡܢ ܬܘܠܡܐ ܘܟܘܕ ܕܐܗܐ ܡܟܝܢܬܐ ܝܠܗ ܕܪܓܫܬܐ ܕܡܘܟܝܢܐ ܝܠܘܦܢܐ ܠܡܦܠܚܬܗ ܐܝܟ ܟܝܠܬܐ ܠܚܝܠܐ. ܐ. ܐܫܪܠܘܦ ܬܘܠܡܐ ܕܐܗܐ ܗܐܬܐ ܡܚܘܠܦܢܐ ܟܠܒܪܐ

ܘܡܫܘܚܬܐ ܘܡܫܘܚܬܟܠܗ̇ ܢܕܒܐ ܡܩܝܡܬܐ
ܠܝܬܐ ܕܡܫܘܚܬܐ ܥܠ ܝܬܪܐ ܠܐ ܡܪܕܝܬܐ
ܡܬܟܬܐ ܟܪܘܪܬܐ ܘܡܦܩܬܐ ܗ̄ܢܐ ܘܕܝܡ
ܟܪܘܟܐ ܕܐܬܐ ܣܦܪܐ ܡܫܘܐܬܐ ܟܡ
ܟܠܐܠܗ̇ ܟܘܬܠܐ (١) ܟܓܡ ܟܟܠܬܐ
ܠܡܪܢܝܬܐ ܕܐܬܐ ܡܫܘܠܘܬܐ ܘܡܬܝܬܐ
ܠܡܫܘܚܬܐ ܠܟܘܦܐ ܐܣܪܐ ܥܠ ܟܠܐ
ܟܡܝܠܝ ܢܝܘܬܢ ܕܘܡܐ ٩،٨ ܢܝܘܬܢ ܐܝܟ
ܡܘܚܘܝܐ ܒܨܘܪܬܐ (٣ — ١) ܘܝܠܗ
ܚܝܠܐ ܗܘܘܐ ܠܚܝܠܐ ܕܢܦܩܐ ܕܪܪܟܐ
ܠܟܘܬܠܐ (١) ܟܓܡ ܠܝܬ ܥܠܡܐ ܕܝܡܐ
ܘܫܢܬܐ ܕܦܬܝܘܬܐ (٤٥). ܘܟܦܠܓܬܐ
ܕܟܘܬܠܬܐ ܟܡ ܗܕܘܡܐ ܟܘܦܐ
ܕܡܫܘܚܬܐ ܡܕܡ ܘܟܗܕ ܗܠܐܬܐ
ܕܟܘܬܠܐ (١) ܟܓܡ ܠ ٩،٨ ܗܘܡܐ
ܟܘܝܐ ܦܝܟ ܡܘܟܬܐ ܡܠܝܟܬܐ ܠܟܝܠܬܐ
ܕܚܝܠܐ ܡܟܘܡܡܐ ܢܝܘܬܢ.

ܨܘܪܬܐ (٣ — ١)

(٣ — ٤) ܚܕܝܘܬܐ ܕܟܝܠܬܐ ܕܚܝܠܐ

ܚܕܝܘܬܐ ܕܟܝܠܬܐ ܕܚܝܠܐ ܝܠܗ̇ ܢܝܘܬܢ. ܘܝܠܗ̇ ܚܝܠܐ ܡܬܒܥܝܢܐ ܠܟܘܬܠܐ (١) ܟܓܡ ܡܢ ܕܘܟܐ ܘܡܫܢܝܠܗ ܗܘܪܘܟܐ ܟܘܡܠܗ (١) ܡܬܪܐ/ܪܦ[٢] ܐܝܟ ܕܒ ܠܠܫܠܗ ܟܦܦܘܫܐ ܐܢܝܢܐ ܘܡܬܝܬܐ ܝܠܗ ܡܬܟܠܬܐ ܕܢܝܘܬܢ. ܕܝܠܗ ܚܝܠܐ ܕܟܘܐ $\frac{١}{٢}$ ܡܢ ܚܝܠܐ ܕܢܦܩܐ ܕܪܪܟܐ ܠܟܘܡܐ ܟܘܬܠܗ (١) ܟܓܡ ܡܘܬܒܐ ܠܝܬ ܥܠܡܐ ܕܝܡܐ ܥܠ ܫܢܬܐ ܕܦܬܝܘܬܐ ܟܘܡܠܗ (٤٥) ܐܝܬ ܗܕܐ ܚܕܝܘܬܐ ܟܝ ܙܥܘܪܬܐ ܡܢ ܢܝܘܬܢ ܠܟܝܠܬܐ ܕܚܝܠܐ ܘܦܫܐ ܡܫܡܗܐ ܕܝܢ ܘܟܘܐ ١٠ –٥ ܢܝܘܬܢ ܗ̄ܢܐ ܘܕܝܡ ١ ܢܝܘܬܢ = ١٠٠٠٠٠ ܕܝܢ.

(٣ — ٥) ܦܘܠܓܐ ܕܚܝܠܐ ܢܩܒܠܐ ܒܚܕ ܦܘܪܐ

ܡܕܡܠܗ ܘܒܬܪܟ ܟܘܢܫܐ ܕܡܫܘܚܬܐ ܒܐܘܪܚܐ ܦܪܝܫܐ ܘܚܕ ܚܝܠܐ ܥܠܗ ܡܫܘܚܬܐ ܟܡܐ ܕܐܝܬ ܟܘܢܫܐ ܕܚܝܠܐ ܥܠܗ ܐܝܟ ܟܘܢܫܐ ܕܡܫܘܚܬܐ ܘܦܫ ܩܪܝܐ ܚܝܠܐ ܠܫܘܕܐ ܕܡܛ ܒܥܘܦܐ ܕܟܕܝ ܚܝܠܐ ܐܘ ܝܗܒ ܒܟܘܢܫܐ ܘܙܘܥܐ ܒܦܘܠܓܐ ܕܐܝܟ ܚܝܠܐ.

ܗܢܐ ܘܟܢ ܐܝ ܗܘܒܒܥܠܗ ܕܬܪܐ ܚܝܠܐ ܒܚܕ ܥܕܢܐ ܥܠ ܓܘܫܡܐ ܡܬܡܚܕܐ ܘܡܬܒܒܥܠܗ ܒܗ ܒܡܘܫܚܬܐ ܡܬܡܚܕܐ ܐܝ ܗܘܐ ܒܐܝܟܢܘܬܗ ܘܣܘܟܐ ܐܘ ܐܫܡܗ ܐܘ ܥܒܕܗ ܘܦܬܠܗ ܒܡܘܫܚܬܐ ܐܢܐ ܚܝܠܐ ܒܚܕ ܚܝܠܐ ܘܡܬܒܒܥܠܗ ܒܐܝܟ ܓܘܫܡܐ ܒܡܘܫܚܬܐ ܒܗܕܗ ܚܝܠܐ ܐܫܟܚܐ ܥܠܗ ܦܘܠܓܐ ܕܟܘܢܫܐ ܕܚܝܠܐ ܡܬܒܒܥܢܐ ܥܠ ܓܘܫܡܐ.

ܦܘܠܓܐ ܕܚܝܠܐ ܢܩܒܠܐ ܒܚܕ ܦܘܪܐ ܘܡܦܩܬܐ ܒܚܕܐ ܢܩܘܕܬܐ :

ܡܢ ܒܬܪ ܕܗܕܐ ܢܩܫܢܝܗ ܕܚܝܠܐ ܠܐ ܒܚܠܦ ܟܘܢܝܗ ܘܙܘܥܝܗ ܐܝ ܦܬܠܗ ܡܬܡܢܐ ܥܠ ܚܝܠܐ ܕܡܬܒܒܥܢܗ ܠܢܘܩܕܬܐ ܐܚܪܝܬܐ ܒܡܕ ܕܐܗܐ ܡܫܘܚܬܐ ܥܠܗ ܡܣܒܒܐ ܕܦܘܠܓܐ ܕܬܪܐ ܚܝܠܐ ܡܡܫ ܐܝܟ (ܐܘ ܡܡܫܡܫܗ) ܒܚܕܐ ܢܩܘܕܬܐ ܘܐܘܐ ܒܐܘܪܚܐ ܒܢܬܫܗ ܕܡܬܒܒܥܢ ܟܘܢܫܐ ܕܗܕܝ ܡܫܘܚܬܐ ܐܘ ܝܗܒ. ܚܙܝ ܒܢܒܐ (١ — ٣).

<u>ܛܘܦܣܐ</u>

ܗܕܝ ܚܝܠܐ $\overleftarrow{ܚ_1}$ ܘ $\overleftarrow{ܚ_2}$ ܡܬܒܒܥܝ ܥܠ ܚܕ ܓܘܫܡܐ ܘܒܚܕܐ ܢܩܘܕܬܐ ܐܝܟܐ ܕܟܘܢܝܐ ܕܦܘܠܓܗ $\overleftarrow{ܚ}$ ܒܗܘܐ ١٠ ܢܝܘܛܢ ܘܙܘܝܬܐ ܥܡ $\overleftarrow{ܚ_1}$ ܘܫܘܐܠܗ ܟܘܢܝܗ.

ܟܡܐ ܝܠܗ ܟܘܢܝܐ ܘܙܘܥܐ $\overleftarrow{ܚ_2}$ ؟

ܫܪܝܐ

ܡܢ ܐܫܟܡܐ ܫܒܝܒܐ

$$\text{ܓܠ ܕ} = \frac{ܚ_{١}}{ܚ} = ١$$

$$\text{ܓܠ ܕ} = \frac{ܚ}{ܚ} = ١$$

ܒ = ٤٥

ܗ = ٩٠° + ܒ = ٩٠° + ٤٥°

ܗ = ١٣٥° ܡܬܘܚܐ ܕܙܘܝܬܐ ܕܒܝܢܬܘ ܚ⃗٢ ܥܡ ܚ⃗١

ܐܝܟ ܡܬܚܙܝܢܐ ܒܨܘܪܬܐ ܕܦܘܠܓܐ = ܚܘܝܕܐ ܕܡܬܚܙܝܢܐ ܒܨܘܪܬܐ ܠܚܝܠܐ ܥܠܝܐ

ܚ = ܚ٢ ܓܝܒ ܒ + ܣܦܝܩܐ

١٠ = ܚ٢ ܓܝܒ ٤٥°

ܚ٢ = ١٠ √٢ ܢܝܘܛ.

ܫܘܩܠܬܐ Equilibriant

ܫܘܩܠܬܐ ܕܡܫܢܝܬܐ ܕܚܝܠܐ ܝܠܗ ܚܕ ܚܝܠܐ ܗܘܐ ܠܦܘܠܓܐ ܕܐܢܝ ܚܝܠܐ ܒܗܘܢܐ ܘܦܠܝܓܠܗ ܒܙܘܢܐ ܘܢܦܠ ܡܫܡܫ ܥܠ ܚܕ ܚܝܠܐ ܕܡܬܬܝܢܘܬܐ ܘܡܬܬܝ ܥܠ ܚܕ ܓܘܫܡܐ. ܗܢܐ ܘܕܝܢ ܐ ܫܘܬܝܬܠܗ ܕܐ ܚܝܠܐ ܥܠ ܓܘܫܡܐ ܘܫܘܬܝܬܠܗ ܥܠܗ ܚܕ ܚܝܠܐ ܘܡܘܬܒܠܠܗ ܠܡܬܬܝܢܘܬܐ ܕܐܢܝ ܚܝܠܐ ܦܫܠܗ ܡܕܝܐ ܚܝܠܐ ܐܚܪܢܐ ܒܫܘܩܠܬܐ ܕܐܢܝ ܚܝܠܐ ܐܝܟ ܒܨܘܪܬܐ (٣ — ٢).

ܨܘܪܬܐ (٣ — ٢)

(٣ — ٦) ܫܚܩܬܐ Friction

ܠܓܠܝܐ ܕܐܢܐ ܕܫܚܩܬܐ ܘܗܘܦ ܡܦܠܚܐ ܡܢ ܡܣܩܐ ܥܠ ܬܦܠܚܐ ܕܦܠܚܬܐ ܐܘܩܝܕܐ ܕܒܚܝܐ ܘܡܬܚܡܠܗ ܬܣܝܡ ܬܪܕܐ ܕܡܠܘܠܘܬܐ ܕܡܦܠܚܐ ܕܡܣܩܐ ܗܠ ܕܬܠܬܐ ܡܢ ܕܡܫܚܐ ܥܠ ܗܦܟܐ ܕܚܝܠܐ ܕܡܘܬܒܠܐ ܠܙܘܢܐ ܕܙܘܥܗ ܡܬܬܢܐ ܥܠܗ ܡܘܬܬܝܢܠܗ ܥܠܗܘ. ܗܡ ܕܐܗܐ ܡܫܝܢܐ ܠܗ ܠܐܡܪܐ ܕܚܝܠܐ ܕܫܚܩܬܐ ܝܠܗ ܚܝܠܐ ܡܬܒܠܠܢܐ ܗܕܐ ܗܡ ܗܕܝ ܬܦܠܚܐ ܒܡܫܚܐ ܕܙܘܥܐ ܕܚܕ

ܡܢܝܘܗܝ ܥܠ ܐܣܪ̈ܐ ܐܘ ܒܡܣܟܢܐ ܕܛܪ̈ܝܬܐ ܕܘܒܠܬܐ ܕܝܢ ܡܢܝܘܗܝ ܥܠ ܐܣܪ̈ܐ. ܒܗܝ ܕܐܗܐ ܝܠܗ ܚܝܠܐ ܗܦܟܢܐ ܐܡܝܢܝܐ ܠܓܘܪ̈ܐ ܕܘܡܪ̈ܐ.

ܐܝܟ ܕܦܬ̈ܐ ܐܡܝܕ̈ܬܐ ܕܓܠܝ̈ܣܐ ܟܒܝܫ̈ܐ ܝܠܗ ܐܘ ܐܡܪ̈ܢܬܐ ܠܐ ܦܠܝܓ ܡܢ ܕܝܠܗ ܚܝܠܬܐ ܬܠܝܘܒ ܒܕ ܠܝܬ ܓܠܝܣܐ ܟܒܝܫ̈ܐ ܒܡܣܘܟܠܐ ܦܘܫܐ. ܡܗܡܘܐܠܝܘܗܝ ܣܘܪ̈ܬܐ ܕܡܚܐ ܠܓܠܝܣܐ ܕܠܗܘܡܐ ܓܡܝܡܐ ܘܙܡܠܐ ܕܚܒܒܢ ܥܠ ܚܦܪ̈ܐ ܘܕܘܟܝ̈ܐ ܒܡܘܟܟܐ ܘܡܕܝ ܐܝܟ ܐܡܠܐ ܠܗܘ ܡܦܪ̈ܬܐ ܕܚܕ ܢܗܪ̈ܐ ܡܢ ܗܘܠܐ ܕܐܗܐ ܓܠܝܣܐ ܐܝܟ ܕܝܠܗ ܓܠܝܐ ܒܨܘܪܬܐ (٣ — ٣) ܒܗܝ ܕܐܗܐ ܡܢ ܟܠܠܬܐ ܕܚܕܬܐ ܝܠܗ ܓܒܬܐ ܕܘܟܝ̈ܐ ܒܡܣܦܪ̈ܐ ܘܐܝܟ ܕܚܙܝ ܠܗܘܡܐ ܐܣܪ̈ܐ ܦܠܝܓ ܕܡܚܐ ܘܠܘܪ̈ܐ ܒܝܢ ܡܪ̈ܘܡܝ ܓܠܝܣܐ ܦܠܝܓܐ ܒܡܒܪܬܐ ܕܐܢ̈ܐ ܘܕܘܟܝ̈ܐ ܘܡܝܩܪ ܚܝܠܐ ܕܚܕܬܐ ܒܝܢܬܘܗܝ ܗܠ ܕܦܬ̈ܐ ܡܪ̈ܘܡܝ ܓܠܝܣܐ ܒܪ̈ܕܝܐ ܡܢ ܡܩܒܘܠܬܐ ܟܪ̈ܐ ܚܝܠܐ ܕܚܕܬܐ ܒܘܝܕܬܐ ܗܪ̈ܐ ܕܟܡܝܠܘ ܠܒܘܪ̈ܟܐ ܕܚܒܒܢ ܕܚܝܠܐ ܕܚܕܬܐ ܒܐܗܐ ܐܝܟܢܘܬܐ ܦܠܝܓܐ ܝܠܗ ܡܢ ܚܝܠܐ ܕܒܪ̈ܝܬܐ ܐܘ ܚܝܠܐ ܕܒܒܟܒܐ ܕܝܘܪ̈ܐ ܐܘ ܕܡܬܐ ܕܓܠܝܣܐ ܚܕܐ.

ܐܨܘܪܬܐ (٣ — ٣)

ܘܐܝܟ ܦܘܫܝܡܐ ܐܣܪ̈ܢܐ ܠܟܠܠܬܐ ܕܚܕܬܐ ܕܝܠܗ ܓܠܝܣܐ ܠܡܬܐ ܥܡ ܚܕܕܐ ܠܡܬܐ ܒܡܝܘܬܐ ܪ̈ܒܐ ܘܠܘܪ̈ܐ ܡܢ ܓܠܝܣܘܬܗ. ܘܡܢ ܝܗܒܬܐ ܠܟܠܠܬܐ ܕܠܘܪ̈ܐ ܒܘܪ̈ܟܐ ܐܠܝܠܗ ܕ ١ / ١٠٠٠٠ ܡܢ ܓܠܝܣܘܬܐ ܓܪܝܪܬܐ ܠܡܬܐ ܥܡ ܚܕܕܐ ܒܗܝ ܕܐܗܐ ܗܘܐ ܣܠܘܩܐ ܥܠ ܝܡܘܬ ܕܠܡܬܐ ܪ̈ܒܐ ܠܒܘܪ̈ܟܐ ܗܪ̈ܐ ܕܡܩܪܒ ܠܓܠܝܣܐ ܕܒܝܢ̈ܐ ܘܕܘܟܝ̈ܐ ܗܠ ܕܦܬ̈ܐ ܓܠܝܣܘܬܐ ܠܡܬܐ ܡܩܝܡܬܐ ܥܠ ܛܒܝܥܬܐ ܕܝܘܡܐ ܕܠܗܘܡܐ ܘܐܗܐ ܡܚܒܒ ܠܠܘܚܡܐ ܕܓܘܡܬܐ ܠܡܬܐ ܠܘܚܡܐ ܡܪ̈ܝܪܐ cold welding ܦܠܝܓܐ ܕܚܝܠܐ ܕܒܒܟܒܐ ܡܪ̈ܪܬܐ ܒܝܢܬܘܗܝ ܘܗܠܐ ܕܦܪܝ ܐܗܐ ܠܘܚܡܐ ܡܪܝܪܐ ܘܗܠܐ ܒܡܪ̈ܘܡܝ ܓܠܝܣܐ ܥܠ ܚܕܕܐ ܒܚܝܠܐ ܝܠܗ ܚܝܠܐ ܕܚܕܬܐ.

ܡܘܕܥܢܐ ܕܫܚܩܬܐ ܘܢܒܥܘܗ̇ :

ܠܫܚܩܬܐ ܡܘܕܥܢܐ ܠܐ ܦܫܝܛ ܡܢܐ ܕܫܘܐ. ܡܘܕܥܢܐ ܟܕ ܕܠܐ ܫܚܩܬܐ ܠܐ ܗ̇ܘ ܡܫܬܟܚܬܐ ܕܐܡܢܐ ܫܘܝܐ ܟܕ ܠܐ ܗ̇ܘ ܡܫܬܟܚܬܐ ܠܦܪܘܫܐ ܕܝܫܒ ܐܘ ܟܠܐ ܕܠܐ ܫܚܩܬܐ ܐܘ ܠܐ ܡܬܝ ܕܢܐܬܐ ܠܡܬܘܢܐ ܐܘ ܡܬܩܢܝܢ ܕܠܐ ܫܚܩܬܐ ܘܠܐ ܗ̇ܘ ܡܫܬܟܚܬܐ ܠܡܬܚܘܠܬܐ ܕܟܠܐ ܓܘ ܓܘܫܡܐ ܕܟܕܢܝܐ ܘܦܫܝܛܐ ܕܟܕ ܬܐ ܐ. ܠܐ ܗܘܐ ܗ̇ܘ ܫܚܩܬܐ ܐܠܐ ܠܫܚܩܬܐ ܢܬܝܐ ܠܐ ܗ̇ܘ ܡܫܬܟܚܬܐ ܡܢܬܝܗ̇ ܡܢ ܓܘܦܣܐ ܐܝܟ ٢٠ ܡܢ ܡܐܘܬܐ ܡܘܡܬܢܐ ܠܡܓܘܕܐ ܓܠܡ ܟܕܠܠܐ ܕܫܚܩܬܐ ܘܟܠܠܐ ܕܡܓܘܕܐ ܘܡܬܟܢܝܗ̇ ܗ̇ܘ ܦܓܪܐ ܕܫܚܩܬܐ ܘܟܠ ܟܠܢܝܐ ܡܘܕܥܢܐ ܕܫܚܩܬܐ ܝܕ ܕܒܪܐ ܗ̇ܝܢ ܡܢ ܢܒܥܘܗ̇.

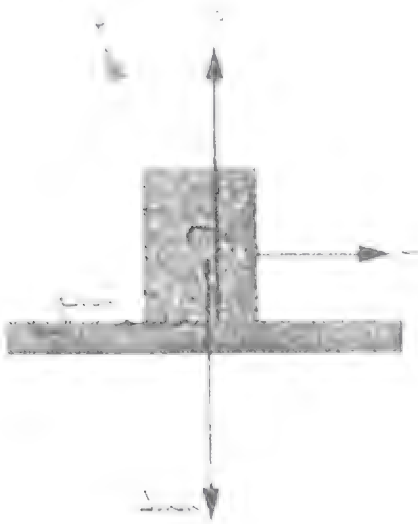
(٣ — ٧) ܐܕܫܐ ܕܫܚܩܬܐ

ܐ. ܦܬܠܘ ܡܘܡܬܢܐ ܓܘܫܡܐ ܥܠ ܦܢܝܬܐ ܐܘܦܩܐ ܚܕܘܬܐ ܓܘܫܡܐ ܒܫܠܝܐ ܥܠ ܦܢܝܬܐ ܒܫܠܐ ܫܠܡܐ ܚܣܠ ܗܘܐ ܡܘܡܬܐ ܕܓܘܫܡܐ ܐܦ ܦܢܝܬܐ ܡܟܟܒ ܥܠ ܓܘܫܡܐ ܒܫܠܐ ܕܗܘܦܟ ܟܒܕܐ (ܗ) ܡܬܦܢܝܐ ܥܠ ܦܢܝܬܐ ܗܘܐ ܠܫܠܐ ܫܠܡܐ ܒܡܫܠܐ ܘܗܦܟܠܗ ܒܢܘܟܝܐ ܘܢܦܠܝ ܟܢܘܫܗ ܥܠ ܚܕܐ ܟܕܡܝܐ ܐܝܟ ܕܠܠܗ ܡܘܚܘܝܐ ܒܐܣܟܡܐ (٣ — ٤) ܘܐܕܫܐ ܕܫܚܩܬܐ ܝܠܗ :

ܐܣܟܡܐ (٣ — ٤)

ܐ - ܚܟܬܐ ܕܫܘܪܝܐ (Static Friction)

ܐܢ ܦܬܠܘ ܠܕܒܪܐ ܠܘܫܡܐ ܒܚܝܠܐ (ܚ) ܡܫܘܢܝܐ ܠܓܫܡܐ ܟܕܐ ܒܝܢ ܕܘܪܘܗ ܓܫܡܐ ܒܡܕܪܐ ܒܝܕܘ ܚܝܠܐ ܫܘܝܐ ܠܚܝܠܐ ܠܕܒܪܐ ܒܚܘܠܐ ܘܦܘܟܝܐ ܠܗ ܒܪܘܟܐ ܦܝܫ ܡܕܪܐ ܒܚܝܠܐ ܕܚܟܬܐ (ܚܫ). ܘܝܕ ܐܗܐ ܚܝܠܐ ܒܘܪܟܬܐ ܕܚܝܠܐ ܠܕܒܪܐ ܗܠ ܕܡܕܪܐ ܠܘܫܡܐ ܒܘܠܟܐ ܘܦܝܫ ܡܕܪܐ ܚܝܠܐ ܒܐܗܐ ܐܢܫܘܬܐ ܒܚܝܠܐ ܕܚܟܬܐ ܕܫܘܪܝܐ (ܚܫ ܫ) ܘܠܒܐ ܗܘܦܝ ܠܟܕܪܐ (ܕ) ܡܢ ܚܝܠܐ ܠܡܘܪܝܐ ܠܠ ܓܫܡܐ ܒܘܪܟܐ ܒܡܠܗ (ܗ) ܕܦܬܚܐ ܡܕܪܟܐ ܒܘܪܟܐ ܕܚܟܬܐ ܕܠܠܠܗ ܫܘܐ ܠܟܘܕܐ ܕܚܟܬܐ ܐܝܢ ܕܠܗ ܡܘܚܘܐ ܒܨܘܪܬܐ (٣ — ٥):



ܨܘܪܬܐ (٣ — ٥)

ܚܝ ܫ = ܕ ܠܕ ܗ = − ܚܝܠܐ ܠܕܒܪܐ. ܘܡܕܟܪܐ ܠܡܘܪܝܐ ܠܗܘܦܝ ܠܟܕܪܐ

ܚܝ ܫ = ܕ ܠܕܠ ܗ = − ܚܝܠܐ ܢܠܡܝܐ ܘܦܫܡܘܬܐ $\frac{\text{ܚܝ ܫ}}{\text{ܕ}}$ ܫܘܡܐ ܒܡܫܘܬܐ

ܡܫܟܚܬܐ ܒܝܢ ܗܕܐ ܓܫܡܐ ܚܕܝܐ ܦܝܫ ܡܕܪܐ ܠܟܘܕܐ ܕܚܟܬܐ ܕܫܘܪܝܐ (ܠܕ ܫ)

$$\text{ܠܕ ܫ} = \frac{\text{ܚܝ ܫ}}{\text{ܕ}} = \frac{\text{ܚܝܠܐ ܠܕܒܪܐ}}{\text{ܚܝܠܐ ܢܠܡܝܐ}} = \frac{\text{ܚ}}{\text{ܚܝܠ}}$$

ܓ- ܫܚܩܬܐ ܕܓܪܫܬܐ (Sliding Friction)

ܟܕ ܓܪܝܪܐ ܠܓܫܡܐ ܒܙܘܥܐ ܘܐܝܟ ܒܡܠܘܠܘܬܐ ܫܘܝܬܐ ܡܬܩܒܠܬܐ ܘܥܠ ܣܛܚܐ ܡܕܝܪܐ ܒܝܕ ܚܝܠܐ ܠܓܪܫܐ ܡܢ ܡܐ ܕܗܘܐ ܥܠܝܗ ܡܕܡ ܘܡܢܐ ܐܘ ܒܪܦܦܐ ܕܓܪܫܬܗ ܘܒܝܕ ܚܝܠܐ ܕܫܚܩܬܐ ܘܐܝܟ ܡܪܢܐ ܗܘ ܐܣܪܢܐ ܒܚܝܠܐ ܕܫܚܩܬܐ ܕܓܪܫܬܐ (ܚܫ ܓܪ) ܘܡܬܚܠܦܐ ܘܝܬܐ ܕܠܢܝܬܐ ܕܗܘܦܐ ܠܚܒܪܐ ܕܓܫܡܐ ܥܠ ܠܓܫܡܐ ܠܘܝܬܐ (ܗ) ܐܝܟ ܒܨܘܪܬܐ (٣ — ٦).

ܨܘܪܬܐ (٣ — ٦)

ܠܚܫܒܐ ܕܫܚܩܬܐ ܥܠ ܓܫܡܐ ܠܢܝܐ ܘܙܘܝܬܐ ܕܫܚܩܬܐ:

ܐܢ ܦܢܝܠܗ ܡܘܬܒܐ ܠܓܫܡܐ ܥܠ ܓܫܡܐ ܐܘܦܩܐ ܚܪܘܫܐ ܘܦܢܝܠܗ ܡܘܪܡܐ ܚܕ ܠܓܒܢܝܗ ܒܙܘܪܬܐ ܢܣܒܬܐ ܗܠ ܕܓܪܐ ܠܓܫܡܐ ܒܙܘܥܐ ܒܡܬܘܚܐ ܕܡܫܚܬܐ ܥܠ ܓܫܡܐ ܡܫܚܬܐ ܢܣܒܬܐ ܐܢ ܐ ܘܝܬܐ ܕܠܢܝܬܐ ܕܓܫܡܐ (ܗ) ܒܗܘܐ ܐܝܟ ܡܘܚܘܝܐ ܒܨܘܪܬܐ (٣ — ٧) ܒܗܘܐ ܚܫ ܓ = ܡ ܓܒ ܗ ، ܪ = ܡ ܓܒܓ ܗ ܘܗܘܐ ܠ ܓ = ܓܠ ܗ ، ܓܒ (ܗ) ܘܝܬܐ ܕܫܚܩܬܐ ܕܓܘܪܐ. ܘܐܢ ܐܡܝܠܗ ܢܣܒܐ ܒܡܠܘܠܘܬܐ ܫܘܝܬܐ ܘܝܪܠܗ ܘܝܬܐ (ܗ) ܠܓܘܝܬܐ (ܗ)

ܘܗܝܡܢܗ ܗܘܐ ܠ ܓܪ = ܓܠ ܗ

ܓܒ ܗ ܓܘܢܐ ܘܝܬܐ ܕܫܚܩܬܐ ܕܓܪܫܬܐ ܘ ܗ ܢ ܗ

ܨܘܪܬܐ (٣ — ٧)

ܓ- ܚܢܟܬܐ ܕܦܪܓܠܬܐ (Rolling Friction)

ܠܡܒܨܪܬܐ ܕܚܝܠܐ ܕܚܢܟܬܐ ܕܙܘܥܐ ܕܠܡܫܐ ܡܣܘܪܐ ܦܫ ܥܒܕܐ ܙܘܥܐ ܒܝܕ ܥܓܠܬܐ ܦܪܬܠܐ ܚܕܐ ܡܕܪܐ ܡܘܕܥܐ ܘܡܢ ܡܢܝܢܐ ܠܡܕܥܢܐ Ball Beerings ܐܘ ܡܚܠܦܢܐ ܐܝܟ ܡܘܚܘܝܢܐ ܒܨܘܪܬܐ (٣ — ٨) ܘܦܝܫ ܡܕܪܐ ܚܝܠܐ ܕܚܢܟܬܐ ܒܗܘ ܐܘܟܝܘܬܐ ܒܚܝܠܐ ܕܚܢܟܬܐ ܕܦܪܕܠܬܐ ܚܢ ܦ ܕܦܝܫ ܡܫܘܚܬܐ ܥܡ ܚܝܠܐ ܚܠܦܢܐ ܚܠ، ܘܦܫܝܬܐ ܥܡ ܦܠܓܐ ܡܚܕܐ ܕܥܓܠܬܐ ܦܡ، ܗܢܐ ܘܒܗ.

$$\text{ܚܢ ܦ} = \text{ܟ ܦ} \; \frac{\text{ܚܠ}}{\text{ܦܡ}}$$

ܘܚܠܦܢܐ ܗܠܘ ܡܢ ܗܘܡܠܬܐ ܥܒܝܕܬܐ ܕܠܥܒܘܕܐ ܕܚܢܟܬܐ ܕܦܪܕܠܬܐ ܚܕܝܘܬܐ ܗܠܘ ܡܥܬܕܐ ܘܐܗܐ ܕܡܘܟܠ ܥܒܘܕܐ ܕܚܢܟܬܐ ܕܥܘܕܢܐ ܘܡܬܕܥܬܐ ܥܡ ܠܝܗ ܠܝܫ ܚܕܝܘܬܐ.

ܥܒܘܕܐ ܕܚܢܟܬܐ ܕܦܪܕܠܬܐ ܕܦܪܙܠܐ = ٠٫٠٠١ ܡܢ ܥܒܘܕܐ ܕܚܢܟܬܐ ܕܡܬܕܥܬܐ ܕܦܪܙܠܐ ܥܠܗ

ܨܘܪܬܐ (٣ — ٨)

ܛܘܦܣܐ

ܦܬܠܘ ܡܘܫܟܬܐ ܠܩܘܛܝܐ ܢܘܡܕܗ ١٠٠ ܢܘܛܢ ܥܠ ܫܛܝܚܐ ܐܘܦܩܝܐ ܡܕܘܟܐ. ܡܫܘܕܐ ܕܫܝܦܬܐ ܕܩܘܝܡܐ ܒܝܢ ܠܩܘܛܝܐ ܘܫܛܝܚܐ = ٠,٢ ܘܡܫܘܕܐ ܕܫܝܦܬܐ ܕܙܘܥܬܐ ܒܝܢܬܗܘܢ = ٠,١ ܫܩܝܠ:

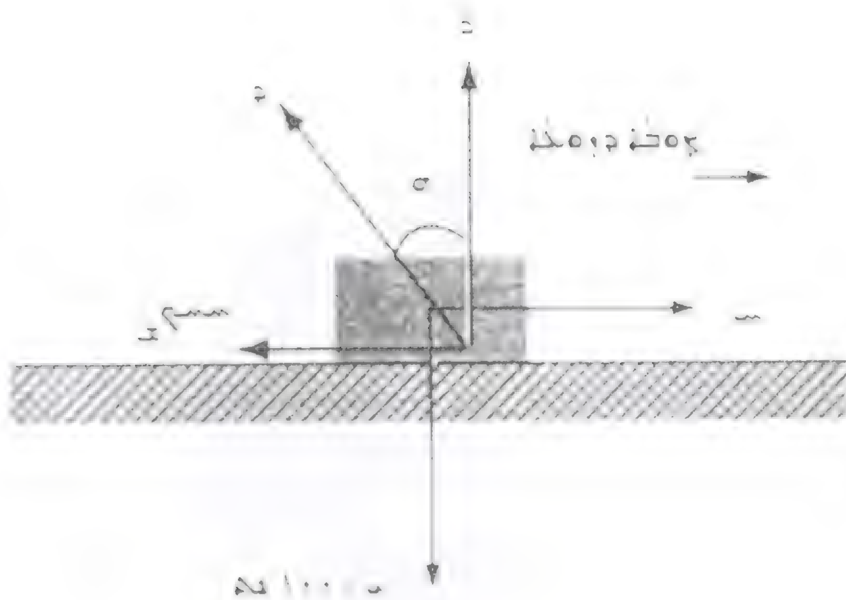
١. ܫܟܘܚ ܐܝܟܢܐ ܕܒܥܐ ܠܩܘܛܝܐ ܕܙܘܥܐ ܘܗܘܦܟ ܥܒܕܐ ܕܫܛܝܚܐ ܥܠ ܠܩܘܛܝܐ ܒܐܗܐ ܐܝܟܢܝܘܬܐ ܘܨܘܪܗ ܚܙܝ ܨܘܪܬܐ (٣ — ٩).

٢. ܫܟܘܚ ܐܝܟܢܐ ܕܦܫ ܠܩܘܛܝܐ ܡܗܠܟܢܐ ܒܫܠܘܠܘܬܐ ܡܫܘܚܬܐ ܘܥܠ ܫܠܝܐ ܗܘܝܐ ܥܠ ܕܐܗܐ ܫܛܝܚܐ ܒ ܐܝܬ ܗܘܦܟ ܥܒܕܐ ܕܫܛܝܚܐ ܥܠ ܠܩܘܛܝܐ ܒܐܗܐ ܐܝܟܢܝܘܬܐ ܘܨܘܪܗ
ܚܙܝ ܨܘܪܬܐ (٣ — ٩).

ܫܪܝܐ

(١) ܪ = ܢ = ١٠٠ ܢܛ

$$\text{ܡ}_{\text{ܫ}} = \frac{\text{ܩ}_{\text{ܫ}}}{\text{ܪ}}$$



ܨܘܪܬܐ (٣ — ٩)

$$٠,٢ = \frac{\text{ܩ}_{\text{ܫ}}}{١٠٠}$$

$\text{ܩ}_{\text{ܫ}}$ = ٢٠ ܢܛ

ܩ = ٢٠ ܢܛ ܗܘܝܐ ܠܫܠܐ ܕܫܝܦܬܐ

ܗܘܦܟ ܥܒܕܐ ܪ = $\sqrt{\text{ܪ}^2 + \text{ܩ}_{\text{ܫ}}^2}$

= $\sqrt{١٠٠^2 + ٢٠^2}$ = ١٠١,٩٨ ܢܛ

ܛܠ ܗ = $\frac{ܡܫ ܟ}{ܪ}$ = $\frac{٢٠}{١٠٠}$ = ٠،٢ ܘܦܬܚܐ ܛܠܗ ܣܘܝܠܐ ܕܓܘܪܐ ܠ ܟܪ

ܗ = ١١،٣١° ܒܡ ܚܒܝܠܐ

ܠ ܟܪ = $\frac{ܡܫ ܟܪ}{ܪ}$

٠،١ = $\frac{ܡܫ ܟܪ}{١٠٠}$

ܡܫ ܟܪ = ١٠ ܢܘ

ܨܘܪܬܐ ٣ — ١٠

ܘܦܩ ܠܚܕܐ ܕ = $\sqrt{ܪ^{٢} + ܡܫ\ ܟܪ^{٢}}$

= $\sqrt{١٠٠^{٢} + ١٠^{٢}}$ = ١٠٠،٥ ܢܘܬ.

ܛܠ ܗ = $\frac{ܡܫ ܟܪ}{ܪ}$ = $\frac{١٠}{١٠٠}$ = ٠،١ ܘܦܬܚܐ ܛܠܗ ܣܘܝܠܐ ܕܓܘܪܐ ܠ ܟܪ

∠ ܗ = ٥،٧١

ܡܚܒܪܢܘܬܐ : ܟܠ ܕܒܣܐ ܕܚܝܠܐ ܗܘܐ ܘܦܩ ܠܚܕܗ ܠܡܘܪܐܝܬ ܟܠ ܠܘܡܐ ܡܘܗܒܐ ܟܠܗ.

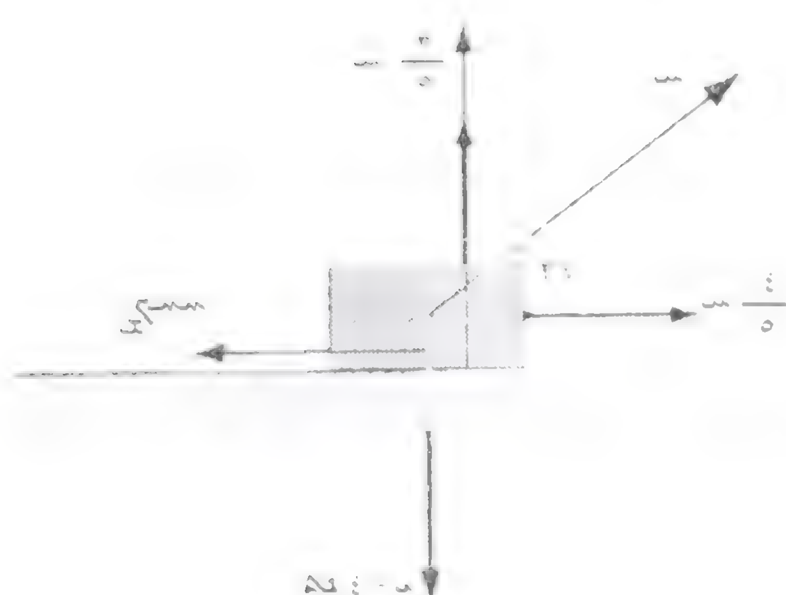
ܠܘܩܡܐ

ܦܪܠܘ ܡܘܗܒܐ ܠܘܡܐ ܢܘܡܪܗ (٤٠) ܢܘܬ. ܟܠ ܕܒܣܐ ܐܘܩܡܐ ܣܪܘܩܐ ܘܦܪܠܘ ܠܕܝܬܐ ܕܝܠܕܐ ܕܡܝܡܐ ܕܪܓ ܟܡ ܐܘܩܡܐ ܘܡܝܬܐ ܕܡܢܠܗ (٣٧°)

ܐ. ܚܫܘܒ ܠܗ ܟܘܝܠܐ ܕܚܝܠܐ ܡܥܒܕܢܐ ܥܠ ܓܒܐ ܕܓܪܝܫ ܠܦܘܫܐ ܡܢ ܫܠܝܘܬܐ
ܐ. ܐܢ ܗܘܐ ܡ ܕ ܬܢ ܠܦܘܫܐ ܘܩܝܡܬܐ (٠،٥) ܚܙܝ ܨܘܪܬܐ (٣ — ١١)
ܒ. ܚܫܘܒ ܠܗ ܟܘܝܠܐ ܕܚܝܠܐ ܐܦܩܝܐ ܠܡܫܘܚܬܐ ܕܐܘܐ ܘܡܟܐ ܚܠܘܠܘܬܐ
ܡܬܘܡܬܐ ܥܠ ܣܛܪܐ ܚܠܝܨܐ ܐܢ ܗܘܐ (ܡ ܕ) ܬܢ ܠܦܘܫܐ ܘܩܝܡܬܐ (٠،٢)
ܚܙܝ ܨܘܪܬܐ (٣ — ١٢).

ܫܪܝܐ

ܐ. ܫܪܝ ܠܚܝܠܐ (ܚ) ܠܬܪܝܢ ܡܫܚܠܦܢ ܐܦܩܝܐ ܘܟܘܢܝܐ $\frac{٤}{٥}$ ܚ
ܘܐܣܪܢܐ ܘܡܦܩܐ ܟܘܢܝܐ ܚ ܥܠ ٣٧ $\frac{٣}{٥}$ ܚ



ܨܘܪܬܐ (٣ — ١١)

ܡܢ ܨܘܪܬܐ (٣ — ١١) ܡܦܠܛܝܢ:

$$\frac{٤}{٥}\,ܚ = ܚܡ\,ܬܢ$$

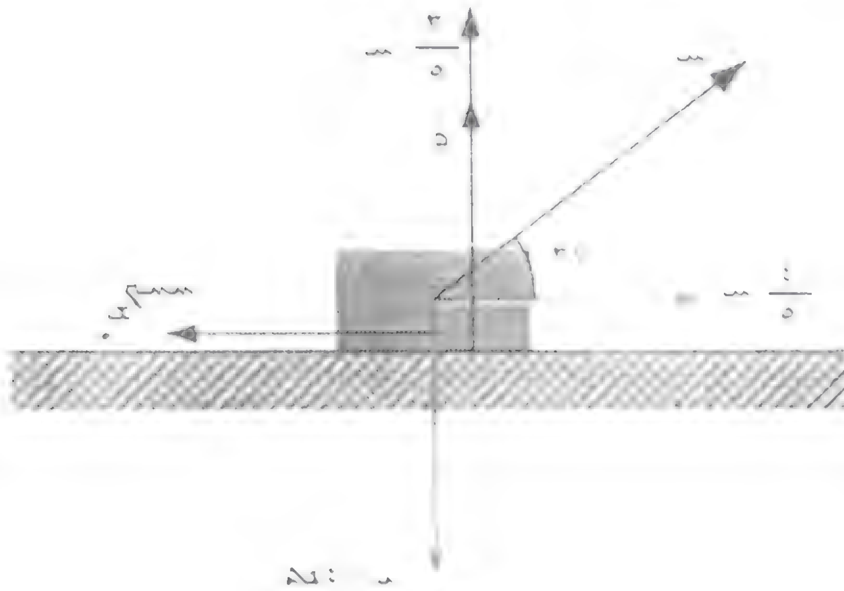
$$ܢ + \frac{٣}{٥}\,ܚ = ٤٠$$

$$ܘܡܕ\,ܠ\,ܬ = \frac{ܚܡ\,ܬ}{ܢ}$$

$$٠،٥ = \frac{\frac{٤}{٥}\,ܚ}{٤٠ - \frac{٣}{٥}\,ܚ}$$

ܘܡܦܠܛܝܢ ܕܟܘܝܠܐ ܗܘܐ: ܚ = ١٨، ١٨ ܢܝܘܛܢ.

ܒ- ܢܫܟܚ ܚܝܠܐ ܕܓܪܫܬܐ ܟܕ ܗܘܐ ܐܬܢܝܚܘܬܐ ܚܠܘ (ܚ) ܢܝܘܛܢ



ܡܪܟܒܬܐ ܐܘܦܩܝܬܐ ܠܗ = $\frac{٤}{٥}$ ܚ

ܘܡܪܟܒܬܐ ܙܩܝܦܬܐ ܠܗ = $\frac{٣}{٥}$ ܚ

ܡܢ ܐܣܟܡܐ (٣ — ١٢) ܒܩܠܝܠ:

ܐܣܟܡܐ (٣ — ١٢)

$\frac{٤}{٥}$ ܚ = ܚܓ ܓܪ

ܪ + $\frac{٣}{٥}$ ܚ = ٤٠

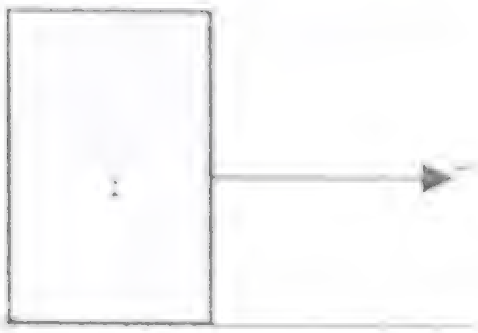
ܘܒܪ ܡ ܓܪ = $\frac{\text{ܚܓ ܓܪ}}{\text{ܪ}}$

٠،٢ = $\dfrac{\frac{٤}{٥}\ \text{ܚ}}{٤٠ - \frac{٣}{٥}\ \text{ܚ}}$

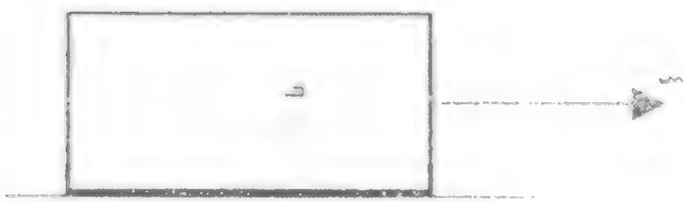
ܘܒܬܪܬܐ ܕܫܘܡܠܐ ܚ = ٨،٧ ܢܝܘܛܢ

(٣ — ٨) ܩܢܘ̈ܢܐ ܕܚܟܟܬܐ

ܒܢ̈ܝܐ ܘܠܦ̈ܢܝܐ ܡܫܘܐܠܗ ܕܠܚܟܟܬܐ ܩܢܘ̈ܢܐ ܕܠܐ̈ܝܢܐ ܠܐ ܡܝܬܠܗ ܢܕܘܟܐ ܡܢ ܦܘܠܚܢܗ ܒܐܘܪܚܬܐ ܘܡܝܘܬܐ ܐܠܘ ܠܒܪܡܐܝܗ ܟܡܐ ܕܐܬܐ



١ . ܠܐ ܟܠ ܚܝܠܐ ܕܚܟܟܬܐ ܟܠ ܒܬܚܘܡܐ ܕܥܛܝܫܐ ܚܕܐ ܕܠܘܒܫܐ ܘܚܝܠܐ ܐܢܫܐ ܠܠܒܪܟܬܐ ܕܡܛܠܬܐ ܡܫܘܢܐ ܒܐܝܢܘܬܐ (ܐ) ܡܢ ܐܨܘܪܬܐ (٣ — ١٣) ܒܘܐ ܚܝܠܐ ܐܢܫܐ ܠܠܒܪܟܬܐ ܕܡܛܠܬܐ ܒܢܬܗ ܘܒܐܝܢܘܬܐ (ܒ) ܐܦ ܕܥܛܝܫܬܐ ܕܥܛܝܫܐ ܚܕܐ ܒܐܝܢܘܬܐ (ܒ) ܒܝܕ ܕܒܐ ܐܠܘ ܒܐܝܢܘܬܐ (ܐ).



ܨܘܪܬܐ (٣ — ١٣)

٢ . ܚܝܠܐ ܕܚܟܟܬܐ ܦܝܫ ܒܐܡܝܢܘܬܐ ܥܡ ܗܘܦܟ ܠܒܪܐ ܠܡܘܪܐ ܒܝܢ ܐܪܘܢܗ ܥܛܝܫܐ ܚܕܐ

٣ . ܠܡܘܪܐ ܕܚܟܟܬܐ ܒܝܢ ܗܘܠܐ ܕܡܢܐ ܒܕ ܕܒܐ ܐܠܘ ܡܢ ܠܡܘܪܐ ܕܚܟܟܬܐ ܒܝܢ ܗܘܠܐ ܦܪܝܩܐ ܒܡܕ ܕܐܗܐ ܦܝܫ ܡܬܘܪܝܐ ܡܥܒܕܐ ܕܡܛܘܪܐ ܡܢ ܗܘܠܐ ܐܠܦ ܡܢ ܗܘܠܐ ܕܡܪܢܝܗ ܡܫܠܝܐ ܐܢܫܬܐ ܡܢ ܡܬܪܘܬ ܟܠܠܬܐ ܕܐܪܘܒܢܐ ܒܫܦܪܐ ܕܗܘܠܐ ܕܡܢܐ ܡܐ ܠܘܦܩܐ ܦܝܫ ܡܬܘܪܝܐ ܡܪܢܐ ܕܡܘܠܒܢܬܐ ܒܘܪܒܢܐ ܡܢ ܦܘܠܒܐ ܐܠܐ ܦܝܫ ܡܬܘܪܝܐ ܡܥܒܕܝܗ ܡܢ ܒܢܝܢܐ ܡܐ ܠܘܦܩܐ.

٤ . ܒܝܕ ܚܝܠܐ ܕܚܟܟܬܐ ܒܘܝܬܬܐ ܕܒ ܠܚܡܐ ܚܕܐ ܘܦܝ̈ܫܐ ܚܟܬܐ ܒܐܗܐ ܐܝܢܘܬܐ ܒܝܢ ܕܘܟܐ ܕܐܠܘ ܒܕ ܒܝܘܪܐ ܕܒܐ ܡܢ ܒܝܢ ܠܘܡܐ ܠܚܡܐ ܒܒܘܡ ܡܢ ܕܝܢܬܐ ܡܠܐ ܠܫܦܪܐ ܕܡܫܐ ܕܥܛܝܫܐ ܚܕܐ ܘܒܝܕܐ ܟܠܠܬܐ ܕܐܪܘܒܢܐ ܒܫܦܪܐ ܒܐܪܘܢܗ ܥܛܝܫܐ ܘܒܝܕ ܚܝܠܐ ܕܚܟܟܬܐ.

٥ . ܟܠ ܚܝܠܐ ܕܚܟܟܬܐ ܒܝܢ ܐܪܐ ܢܛܝܫܐ ܟܠ ܒܢܘܬܢܗ ܘܗܘܐ ܚܝܠܐ ܒܝܕ ܕܒܐ ܐ. ܗܘܝ ܐܪܘܢܗ ܥܛܝܫܐ ܚܕܡܫܐ ܘܒܝܕ ܒܐܓܠܬܐ ܕܐܪܘܒܢܗ ܐܘ ܒܒܘܬܢܗ ܐܦ ܠܪܛܒܘܬܐ ܘܕܠܐ ܕܡܫܡܫܘܬܐ ܘܡܬܡܨܝܬܐ ܕܥܛܝܫܐ ܡܬܒܕܢܘܬܐ ܒܠܡܘܪܐ ܕܚܟܟܬܐ ܒܢܝܬܗ

٦ - ܐܢܪܓܝܐ ܕܚܝܘܬܐ ܟܕ ܗܘܝ ܠܘܬܡܐ ܚܝܢ ܒܪܘܚܐ ܡܬܗܦܟܐ ܡܢ ܦܘܚܐ
ܐܢܪܓܝܐ ܗܠܘ ܕܟܐ ܘܐܗܐ ܒܟܠܬܐ ܕܠܐ ܐܢܫܒܬܐ ܕܒܛܢܚܐ ܕܐܢܝ ܠܘܬܡܐ ܚܢܐ
ܠܗܦܡܬܐ ܕܪܘܚܐ ܡܢ ܐܘܟܣܓܢ ܘܐ. ܒܟܪܠܗ ܡܠܝܠ ܡܢ ܦܘܚܐ ܘܐܘܟܣܓܢܗ
ܒܛܢܚܐ ܟܕ ܐܢܪܓܝܐ ܕܚܝܘܬܐ ܒܟܠܬܐ ܕܟܝܡܝܐ ܕܒܛܢܚܐ ܒܐܘܟܣܓܢ ܕܗܘܠܐ
ܚܢܐ ܐܚܪ ܚܕܝܐ. ܒܗܕ ܕܐܗܐ ܡܬܬܒܝ ܡܬܬܐܙܝܐ ܕܐܢܠܐ ܒܗܪܟܐ ܒܚܡܐ ܪܡܚܐ
ܐܝܟ ܟܪܘܒܐ ܠܒܪܟܬܐ ܕܐܢܠܐ ܠܗ ܐܚܘܟܐ ܒܗܪܟܐ ܠܡܣܝܪܬܐ ܕܚܝܠܐ
ܕܚܝܘܬܐ.

٧ - ܚܝܠܐ ܕܚܝܘܬܐ ܟܕ ܠܘܬܡܐ ܠܡܒܡܐ ܠܐ ܒܚܠܟ ܒܝܘܪܬܐ ܠܠܝܬܐ
ܒܒܚܠܟܬܐ ܕܩܠܘܠܘܬܐ ܕܠܘܬܡܐ ܚܢܐ. ܗܘܝ ܠܗ ܡܚܘܒܐ ܕܩܠܘܠܘܬܐ
ܡܝܕܝܐ ܘܠܐ ܕܟܐ ܒܠܝܐ.

(٣ — ٩) ܚܘܡܣܬ̈ܐ Torques

ܡܢ ܡܟܒܪܢܘܬܐ ܕܚܝܠܐ ܝܕܝܥܐ ܝܠܗ ܦܪܬܠܬܐ ܕܠܘܬܡܐ ܚܕܪ ܗܕܪܐ
ܡܬܚܕܐ ܐܘ ܢܡܘܣܐ ܡܬܚܕܬܐ ܘܐ. ܒܟܪܠܗ ܦܪܙܘܦܐ ܕܦܬܚ ܗܕܟܐ ܘܠܐ ܟܠܗ
ܕܢܝܟ ܐܘ ܠܒܪ ܠܗܕܟܐ ܒܚܝܠܐ ܡܬܚܕܐ ܕܦܪܬܠܬܗ ܚܕܪ ܗܕܪܐ ܕܢܘܡܣܗ.
ܦܬܐ ܡܕܝܬܐ ܠܒܪܬܐ ܕܚܝܠܐ ܠܦܪܬܠܬܐ ܕܠܘܬܡܐ ܚܕܪ ܗܕܪܐ
ܡܬܚܕܐ ܒܚܘܡܣܬ̈ܐ ܕܚܝܠܐ (ܚܘܡ) ܘܝܠܗ ܡܢ ܒܘܢܠܐ ܡܟܝܒܢܐ ܘܝܠܗ
ܦܠܛܐ ܕܒܘܦܦܐ ܙܘܟܝܐ ܠܡܘܚܢܘܬܐ (ܟܕ ܗܕܪܐ ܕܦܪܬܠܬܐ ܘܢܡܘܣܐ)
ܕܡܟܒܪܢܘܬܐ ܕܚܝܠܐ) ܒܚܝܠܐ ܒܢܬܗ ܐܝܟ ܡܘܚܘܐ ܒܐܣܟܡܐ (٣ — ١٤).

$$\vec{ܚܘܡ} = \vec{ܪ} \times \vec{ܚ}$$



ܐܣܟܡܐ (٣ — ١٤)

ܟܘܕ ܕܐܗܐ ܒܡܘܬܐ ܡܝܢܝܬܐ
ܠܚܘܡܣܬ̈ܐ ܒܘܐ ܠܦܘܬ ܐܬܐ ܕܒܘܦܦܐ
ܙܘܟܝܐ ܠܡܟܝܒܢܐ ܝܠܗ:

$$ܚܡ = ܪ\ ܚ\ ܓܒ\ ܗ$$

$$ܘܕ = ܪ\ ܓܒ\ ܗ = \text{ܕܪܥܐ ܕܚܘܡܣܬ̈ܐ (ܕ)}$$

$$ܚܘܡ = ܕ\ ܚ$$

ܘܚܕܢܘܬܗ ܡܝܬܪܐ. ܒܢܘܟܝ ܟܘܕ ܕܐܗܐ
ܒܘܢܠܐ ܡܝܢܝܐ ܠܚܘܡܣܬ̈ܐ ܒܘܐ ܦܠܛܐ
ܕܒܘܦܦܐ ܕܚܝܠܐ × ܡܘܚܢܘܬܐ ܐܡܘܪܝܬܐ

ܡܢ ܢܘܦܩܐ ܕܣܘܡܟܐ ܠܚܝܠܐ ܕܦܘܠܚܢܐ ܕܚܝܠܐ ܢܦܠܗ ܐܘ ܠܡܫܚܬܐ ܕܚܝܠܐ ܕܥܒܕܗ

ܦܫ ܚܫܝܒܐ ܣܘܡܟܐ ܡܘܡܟܐ (+) ܐܝ. ܦܘܪܟܠܠܗ ܠܓܘܡܟܐ ܕܫܥܬܐ ܡܚܘܐ ܕܥܒܕܐ ܘܦܫ ܚܫܝܒܐ ܠܠܐܘܝ (−) ܐܝ. ܦܘܪܟܠܠܗ ܠܓܘܡܟܐ ܟܘܢܐ ܕܡܚܘܐ ܕܥܒܕܐ.

ܡܘܕܥܢܐ ܝܠܗ ܕܦܠܛܝܣ ܠܬܪܬܐ ܕܐܢܝ ܡܢ ܡܢ ܦܬܠܗ ܕܟܪܐ.

١ . ܣܘܡܟܐ ܕܟܠ ܚܝܠܐ ܟܪܒ ܗܘ ܐܘ ܡܫܚܬܗ ܒܥܕܢܐ ܕܣܘܡܟܐ ܛܘܐ ܡܦܡܐ ܒܗ܊ ܒܘܟܪܐ ܒܡܘܕܥܐ ܒܝ ܡܕܢܐ ܕܣܘܡܟܐ ܘܚܝܠܐ ܕܦܘܠܚܢܐ ܕܚܝܠܐ ܐܘ ܡܫܚܬܐ ܕܐܗܐ ܚܝܠܐ ܛܘܐ ܡܦܡܐ.

٢ . ܣܘܡܟܐ ܕܟܠ ܚܝܠܐ ܚܕ ܡܕܢܐ ܡܫܚܬܐ ܛܘܐ ܒܘܢܝܐ ܡܘܠܚܢܐ ܠܣܘܡܟܐ ܕܡܕܒܪܗ ܚܕ ܡܕܢܐ ܒܢܦܫܗ.

٣ . ܒܘܢܝܐ ܡܘܠܚܢܐ ܠܣܘܡܟܐ ܕܕܟܐ ܚܝܠܐ ܚܕ ܡܕܢܐ ܡܫܚܬܐ ܛܘܐ ܣܘܡܟܐ ܕܦܘܠܛܝܣܗ ܚܕ ܡܕܢܐ ܒܢܦܫܗ ܘܦܫ ܡܦܘܠܛܐ ܡܢܗ ܕܣܘܡܟܐ ܕܟܠ ܚܝܠܐ ܚܕ ܡܕܢܐ ܡܫܚܬܐ ܛܘܐ ܒܘܢܝܐ ܡܘܠܚܢܐ ܠܣܘܡܟܐ ܕܡܕܒܪܗ ܚܕ ܡܕܢܐ ܒܢܦܫܗ.

(٣ — ١٠) ܬܩܘܦ ܚܝܠܐ Equilibrium

ܦܫ ܐܡܝܪܬܐ ܠܓܘܡܟܐ ܒܬܚܘܬܐ ܕܬܩܘܦ ܚܝܠܐ ܡܚܝܒܬܐ ܠܡܝܬܪܐ ܗܘܐ:

١ — ܒܬܚܘܬܐ ܕܬܩܘܦ ܚܝܠܐ ܡܬܝܢܢܐ ܗܘܐ ܐܝܢ ܕܗܘܐ ܠܓܘܡܟܐ ܬܠܬܐ ܐܘ ܡܝܬܢܐ ܒܡܠܘܠܘܬܐ ܡܫܝܚܬܐ ܘܟܠ ܚܝܠܐ ܗܕܝܟܐ.

٢ — ܒܬܚܘܬܐ ܕܬܩܘܦ ܚܝܠܐ ܕܦܪܟܠܬܐ ܗܘܐ ܐܝܢ ܠܐ ܬܫܠܦܐ ܬܚܘܬܗ ܘܡܢܝܢܐ ܕܦܪܟܠܬܐ ܐܘ ܦܪܟܠ ܒܡܠܘܠܘܬܐ ܘܡܫܝܚܬܐ ܡܫܝܚܬܐ ܒܗܘܠܐ ܘܙܘܥܐ

ܬܪܝܢܐ ܕܬܩܘܦ ܚܝܠܐ ܡܚܝܒܬܐ ܠܡܝܬܪܐ:

١ — ܡܐ ܕܗܘܐ ܠܓܘܡܟܐ ܒܬܚܘܬܐ ܕܬܩܘܦ ܚܝܠܐ ܡܬܝܢܢܐ ܘܠܐ ܕܗܘܐ ܦܘܠܛܐ ܕܚܝܠܐ (ܦ) ܡܟܒܕܢܐ ܥܠ ܠܓܘܡܟܐ ܛܘܐ ܡܦܡܐ: ܦ = ܡܦܡܐ

ܘܒܐܗܐ ܗܘܐ ܦܘܠܛܐ ܕܡܕܒܪܐ ܡܫܡܗܐ ܡܦܡܐ ܗܘܐ ܐܝܢ:

ܡܘܡܢܬܐ ܕܚܝܠܐ ܟܪܘܟܐ ܕܣܛܪܐ (+ܣ) = ܡܘܡܢܬܐ ܕܚܝܠܐ ܟܪܘܟܐ ܕܣܛܪܐ (−ܣ)
ܘܗܘܐ ܦܘܠܚܢܐ ܕܡܬܒܥܐ ܓܒܐ ܫܘܝܐ ܗܘܐ ܐܕܝܢ :

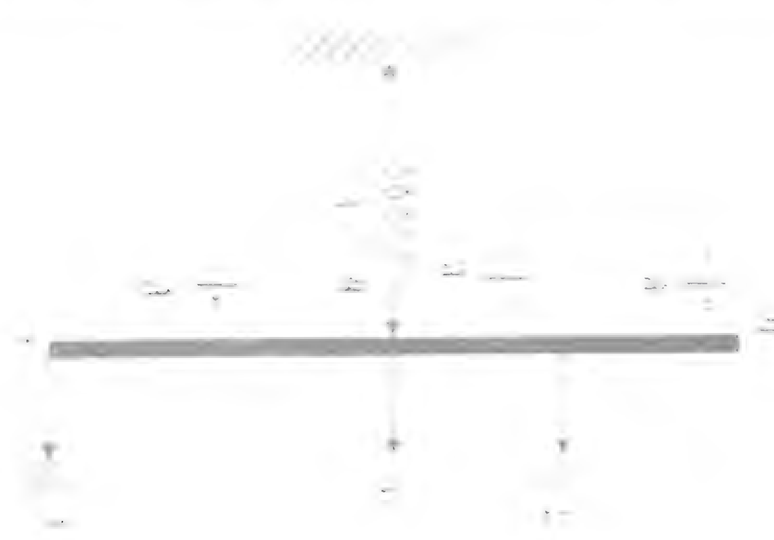
ܡܘܡܢܬܐ ܕܚܝܠܐ ܟܪܘܟܐ ܕܣܛܪܐ (+ܓ) = ܡܘܡܢܬܐ ܕܚܝܠܐ ܟܪܘܟܐ ܕܣܛܪܐ (−ܓ)

٢ . ܐܢ ܗܘܐ ܠܫܩܠܐ ܟܠܗ ܢܛܪܐ ܕܫܘܝܘܬ ܚܝܠܐ ܕܡܬܬܠܬܐ ܥܠܐ ܗܘܐ ܦܘܠܚܢܐ ܕܚܘܫܒܢܐ ܡܬܬܒܥܢܐ ܟܠܗ = ܫܘܝܐ ܗܘܐ ܐܕܝܢ :

ܡܘܡܢܬܐ ܕܚܘܫܒܢܐ ܕܡܬܬܠܬ ܠܓܘܫܡܐ ܟܪܘܟܐ ܕܝܡܝܢܐ ܕܡܨܥܬܐ ܕܬܩܠܐ =
ܡܘܡܢܬܐ ܕܚܘܫܒܢܐ ܕܡܬܬܠܬ ܠܓܘܫܡܐ ܟܪܘܟܐ ܕܣܡܠܐ ܠܘܬܐ ܕܡܨܥܬܐ ܕܬܩܠܐ

ܡܬܚܙܝܐ ܗܠܝܢ ܒܕܘܟܬܐ ܬܪܬܝܢ ܕܫܘܝܘܬ ܚܝܠܐ ܒܬܩܠܐ ܕܐܟܐ :

١. ܫܩܘܠ ܩܢܝܐ ܡܫܘܚܬܐ ܡܢܝܢܐ (ܠ) ܡܬܪܐ ܘܡܫܡܥܐ (ܚ) ܢܘܛܢ ܘܬܠܝܐ ܡܢ ܡܨܥܬܗ ܒܡܫܬܢܬܐ ܫܘܝܘܬܐ ܘܬܠܝ ܢܘܛܢܐ ܒܩܘܦܐ (ܐ) ܡܘܡܢܬܗ (ܚ١) ܢܘܛܢ. ܘܬܠܝ ܒܢܘܟܪܐ ܐܚܪܢܐ ܕܡܫܬܢܬܐ ܡܢ ܩܘܦܐ (ܒ) ܢܘܛܢܐ ܡܘܡܢܬܗ (ܚ٢) ܢܘܛܢ. ܘܐܝܟ ܕܗܘܐ ܒܡܘܬܒܐ ܒܫܘܝܘܬܐ ܕܬܩܠܐ ܕܫܘܝܘܬ ܚܝܠܐ ܠܡܬܪܐ ܐܝܟ ܒܨܘܪܬܐ (٣ — ١٥) ܒܫܘܝ ܡܘܡܢܬܐ (ܚ٢) ܫܘܚܠܦܐ ܬܪܝܢ ܠ ٢ ܚ١) ܘܡܬܚܙܐ ܕܡܘܡܢܬܐ



$ܚ = ܚ_١ + ܚ_٢$

$ܚ_٢ \times \frac{١}{٤} ܡܪ = ܚ_١ \times \frac{١}{٢} ܡܪ$

ܨܘܪܬܐ (٣ — ١٥)

ܘܫܘܝܘܬܐ ܚ٢ ܫܘܚܠܦܐ ܗܘܐ ܬܪܝܢ ܠܡܠܘܐ ܕܫܘܝܘܬܐ ܚ١ . ܗܘܐ ܐܕܝܢ
ܚ٢ = ٢ ܚ١ ܘܡܫܬܚܠܦܐ ܒܡܘܡܢܬܐ ܠܚܒܪܬܐ

$٢ ܚ_١ \times \frac{١}{٤} ܡܪ = ܚ_١ \times \frac{١}{٢} ܡܪ$

$ܚ_١ ܡܪ = ܚ_١ ܡܪ$

ܘܗܘܐ ܥܘܡܩܐ ܡ٢ ܡܫܘܚܬܢܝܬܐ ܬܪܝܢ ܠܠܘܦܐ ܕܥܘܡܩܐ ܡ١. ܗܢܐ ܐܡܝܢ
ܡ٢ = ٢ ܡ١ ܘܡܫܠܡܬܐ ܥܡܘܠܬܐ ܠܚܒܪܬܐ
ܗܢܐ ܐܡܝܢ ܣܘܡܡ̈ܢܐ ܥܡܘܪ̈ܐ ܕܡܣܠܘܐ ܕܥܠܬܐ = ܣܘܡܡ̈ܢܐ ܥܡܘܪ̈ܐ ܕܡܘܦܠܢ̈ܐ ܠܘܟܐ ܕܡܣܠܘܐ ܕܥܠܬܐ

ܛܘܦܣܐ

ܠܘܚܐ ܡܫܘܝܢܐ ܝܘܪܟܗ (٤) ܡܬܪ̈ܐ ܘܝܘܩܪܗ (٢٠٠) ܢܝܘܛܢ ܣܝܡ ܥܠ ܬܪܝ ܡܣܡܟ̈ܐ ܒܣܘܦܗ (ܐ،ܒ) ܘܠܐܠܗ ܦܪܙܘܦܐ ܝܘܩܪܗ (٦٠٠) ܢܝܘܛܢ ܥܠ ܒܪܘܚܩܐ (١) ܡܬܪܐ ܡܢ ܣܘܦܐ (ܐ) ܐܝܟ ܡܘܚܘܝܢܐ ܒܨܘܪܬܐ (٣ — ١٦) ܚܫܘܒ ܗܘܦܟܐ ܠܚܒܪܐ ܕܟܠ ܡܢ ܬܪܘܝܗ ܡܣܡܟ̈ܐ.

٢٠٠ ܢܝܘܛܢ

٦٠٠ ܢܝܘܛܢ

ܨܘܪܬܐ (٣ — ١٦)

ܫܪܝܐ

ܒܪ ܕܗܘܬܐ ܒܫܘܝܘܬܐ ܕܥܘܡܩܐ ܢܦܠܐ ܠܗ ܒܗܘܐ ܦܘܠܚܢܐ ܕܚܝܠܐ = ܩܦܝܠܐ

ܒܘܢܝܐ ܕܚܝܠܐ ܠܥܠ = ܒܘܢܝܗ ܠܬܚܬ

ܪ١ + ܪ٢ = ٢٠٠ + ٦٠٠

= ٨٠٠ ܢܝܘܛܢ

ܘܦܘܠܚܢܐ ܕܣܘܡܡ̈ܢܐ = ܩܦܝܠܐ ܘܒܡܠܬܐ ܕܣܘܡܡ̈ܢܐ ܣܪܕ ܥܘܡܩܐ (ܐ)

ܒܘܢܝܐ ܕܣܘܡܡ̈ܢܐ ܥܡܘܪ̈ܐ ܕܙܘܟܐ ܕܡܣܠܘܐ ܕܥܠܬܐ = ܒܘܢܝܗ ܕܡܘܦܠ ܙܘܟܐ ܕܡܣܠܘܐ ܕܥܠܬܐ

ܪ١ × ܩܦܝܠܐ + ܪ٢ × ٤ = ٦٠٠ × ١ + ٢٠٠ × ٢٠٠

ܪ٢ = ٢٥٠ ܢܝܘܛܢ

ܪ١ = ٨٠٠ - ٢٥٠

= ٥٥٠ ܢܝܘܛܢ

ܫܪܛܐ ܡܫܚܬܢܝܐ ܠܫܘܝܘܬ ܝܘܩܐ

Geometrical Condition of Equilibrium

ܐ. ܗܘܝܒܠܗ ܬܠܬܐ ܚܝܠܐ ܠܐ ܡܩܒܠܢܐ ܢܦܠܐ ܥܡܕ ܥܘܕܐ ܥܠ ܓܘܫܡܐ ܘܦܝܫܠܗ ܓܘܫܡܐ ܒܫܝܢܘܬܐ ܕܫܘܝܘܬ ܝܘܩܐ ܘܠܐ ܕܐܦܫ ܚܙܝܐ ܕܡܢܝܢܐ ܕܐܢܐ ܚܝܠܐ ܐܘ ܡܚܫܒܬܐ ܕܐܢܐ ܚܝܠܘܬܐ ܠܣܕܪܐ ܢܩܫܘܬܐ ܦܪܝܫܐ ܡܕܝܢܬܐ ܢܩܫܘܬܐ ܕܫܪܛܐ ܡܫܚܬܢܝܐ ܠܫܘܝܘܬ ܝܘܩܐ ܐܠܐ ܐ. ܗܘܝܒܠܗ ܚܕܐ ܡܢ ܗܠܟܐ ܚܝܠܐ ܥܠ ܓܘܫܡܐ ܘܒܫܝܢܘܬܐ ܕܫܘܝܘܬ ܝܘܩܐ ܗܘܐ ܡܫܝܢܐ ܠܗ ܠܓܘܫܡܐ ܕܐܢܐ ܚܝܠܐ ܠܗܠܟܐ ܚܝܠܐ ܒܠܚܘܕ ܒܐܘܪܚܐ ܕܐܫܟܚܐ ܕܦܠܛܐ ܕܟܠ ܚܕ ܚܝܠܐ ܘܡܚܠܦܬܐ ܒܝܢܝܗ ܒܦܠܛܐ.

ܛܘܦܣܐ

ܫܩܠܬܐ ܡܢ ܒܝܬܐ ܡܘܪܟܐ (٥) ܡܝܬܪܐ ܘܝܘܩܐ (٢٠٠) ܢܝܘܛܢ. ܫܚܝܩܐ ܥܠ ܓܘܕܐ ܘܫܩܝܠܐ ܒܪܫܐ ܬܚܬܝܐ (٣) ܡܝܬܪܐ ܡܢ ܫܬܐܣܐ ܕܐܪܥܐ ܘܦܫܝܛܐ ܚܕܘܪܐ ܐܝܟ ܡܚܘܝܐ ܒܨܘܪܬܐ (٣ — ١٧) ܚܫܘܒ ܩܠܗ ܕܡܘܩܦ ܚܒܝܫܐ ܕܐܪܥܐ ܘܕܓܘܕܐ ܥܠ ܪܫܐ ܕܫܩܠܬܐ.

ܫܪܝܐ

ܐܒ = $\sqrt{٥^{٢}\;\;٣^{٢}}$ = ٤ ܡܝܬܪܐ

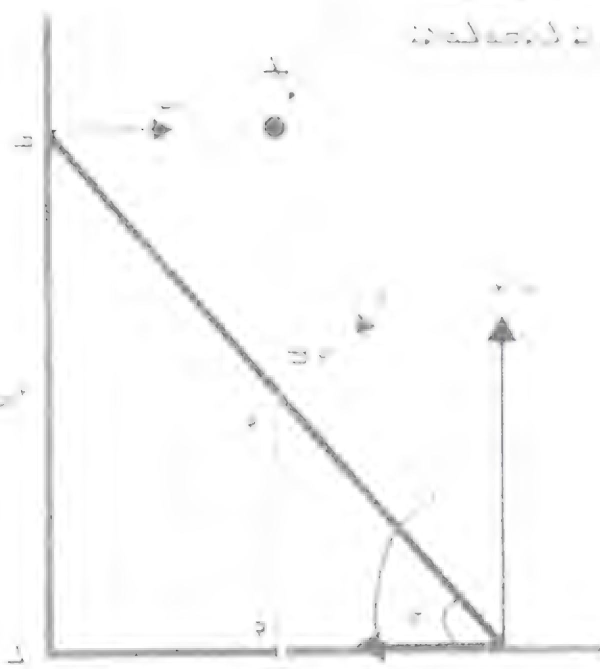
ܡܢ ܕܡܝܐ ܕܡܬܠܬܐ ܐ ܒ ܓ . ܐ ܕ ܕ

ܒܗܘܐ ܐ ܕ = ٢ ܡܝܬܪܐ

ܘܒܪ ܓܘܪܐ ܫܩܝܠܐ ܠܗ ܒܗܘܐ (ܣ) ܫܩܘܠܝܐ ܥܠܗ ܐܦܫ ܥܡ ܡܐܫܬܐ ܕܢܘܩܙܐ ܕܓܘܫܡܐ ܠܗ ܢܩܘܫܬܐ (ܛ) ܘܠܗ ܢܩܘܫܬܐ ܕܫܪܛܐ ܡܫܚܬܢܝܐ ܒܗܘܕ ܕܐܗܐ ܡܘܦܩ ܚܒܝܫܐ ܕܐܪܥܐ (ܗ) ܥܠ ܪܫܐ ܕܫܩܠܬܐ ܐܘ ܡܐܫܬܗ ܘܠܐ ܕܥܒܕ ܒܢܩܘܫܬܐ (ܛ) ܒܗܘܢ ܒܫܘܝܘܬܐ ܕܫܘܝܘܬ ܝܘܩܐ ܝܠܗ.

ܒܗܘܕ ܕܐܗܐ ܡܘܡܢܐ ܕܚܝܠܐ ܒܪܘܣܐ

(+ܣ) = ܡܘܡܢܬܐ ܒܪܘܣܐ (−ܣ)



ܨܘܪܬܐ (٣ — ١٧)

ܘܟܘܠܢܐ ܕܚܝܠܐ ܒܝܘܒܐ (+ܨ) = ܟܘܠܢܝܗ ܒܝܘܒܐ (−ܨ)

σ ܨ = ٢٠٠ ܢܝܘܛ. ܘܒܥܠܬܐ ܕܣܘܡܟܐ ܚܕ ܢܝܘܛܐ ܐ ܒܗܘܐ

٣ ܣ = ٢٠٠ × ٢

ܣ = ١٣٣.٣٣ ܢܝܘܛ

σ ܣ = ١٣٣.٣٣ ܢܝܘܛ

ܐܠܐ σ = √((σ ܣ)٢ + (σ ܨ)٢)

σ = √((١٣٣.٣٣)٢ + (٢٠٠)٢)

σ = ٢٤٠.٣٧ ܢܝܘܛ

ܛܐ ܗ = ٣ / ٢

= ٥٦.٣١ ܕܪܓܐ

ܐܘ ܛܐ ܗ = σ ܨ / σ ܣ = ٢٠٠ / (٤٠٠ / ٣) = ٣ / ٢

(٣ — ١١) ܙܘܓܐ Couple

ܐܢ ܡܬܒܕܠܝܢ ܬܪܝܢ ܚܝܠܐ ܫܘܝܐ ܚܕ ܠܘܩܒܠ ܚܕ ܘܗܘܘ ܥܠܝܗ ܟܕ ܢܦܩܝܢ ܒܝܘܒܐ ܘܠܐ ܥܠ ܚܕ ܣܪܛܐ ܕܡܬܒܕܪܢܘܬܐ ܐܦ ܕܠܘܬܗ ܥܠ ܚܦܝܬܐ ܐܠܐ ܡܥܒܪ ܠܩܘܡܐ ܘܡܠܐ ܕܦܪܨܘܦܐ ܒܡܬܒܕܪܢܘܬܐ ܕܣܘܡܟܐ ܕܬܪܘܢ ܚܝܠܐ ܣܝܪܐ ܡܪܝܐ ܕܦܪܨܘܦܐ ܘܦܬܝ ܡܪܝ ܐܢܐ



ܨܘܪܬܐ (٣ — ١٨)

ܗܕܐ ܚܝܠܐ ܟܢܫܝܐ ܡܘܙܘܢܬܐ ܐܝܟ ܒܨܘܪܬܐ (٣ — ١٨) ܘܡܢ ܦܘܫܩܐ ܕܐܘܐ ܦܫܘܛܐ ܐܝܟ ܕܟܠܗ ܦܫܝܛܘ ܐܘ ܡܫܚܐ ܡܬܬܦܫܩܬܐ ܐܝܟ ܗܕܟ ܘܝܠܗ ܟܕ ܚܝܠܐ ܕܡܚܝܬܐ ܒܘ ܒܕܘܟܬܐ ܦܠܓܐ ܕܡܬܒܕܪܢܘܬܗ ܒܡܘܙܘܢܬܐ ܕܟܝܠܬܐ ܡܬܦܫܩܢܐ ܐܚܪܢܐ

ܚܘܫܒܢܐ ܕܡܘܙܘܢܬܐ : ܐܝ ܒܚܘܝܬܐ ܡܚܘܝܢܬܐ ܠܟܠ ܡܢ ܗܕܘܢܗ ܚܝܠܐ ܕܡܘܙܘܢܬܐ ܝܘܡ ܚ ܢܘܬ. ܘܟܘܠܒܐ ܠܡܥܒܕܐ ܒܢ ܗܕܘܢܗ ܚܝܠܐ ܕܟܒܝܫܗ ܒ، ܡܬܚܬܐ ܐܝܟ ܒܨܘܪܬܐ (٣ — ١٩) ܒܒܥܠܬܐ ܕܚܘܫܒܢܐ ܚܕ ܥܠ ܗܕܢܐ ܠܗ ܓܘܫܡܐ ܡܬܩܒܒܐ ܒܡܘܙܘܢܬܐ ܐܘ ܠܒܪ ܡܢܗ ܐܝܟ ܗܕܢܐ ܘ، ܡܢ ܦܘܫܩܐ ܗܘܐ ܚܘܫܒܢܐ ܡܘܙܘܢܬܐ

$$ܡܡ = (ܒ + ܡܪ)\ ܚ + ܡܪ\ ܚ$$

$$ܡܡ = -ܒ\ ܚ \quad ܡܪ\ ܚ + ܡܪ\ ܚ$$

$$ܡܡ = -ܒ\ ܚ\ ܡܚܬܐ .ܢܘܬ.$$

ܒܗܕܐ ܐܠܦܐ ܗܘܠܘ ܥܠܗ ܕܚܘܫܒܢܐ ܡܬܒܕܪܢܐ ܦܪܫܠ ܠܓܘܫܡܐ ܒܙܘܓܐ ܕܦܪܫܠܬܐ ܕܡܩܘܐ ܕܒܠܬܐ

ܨܘܪܬܐ (٣ — ١٩)

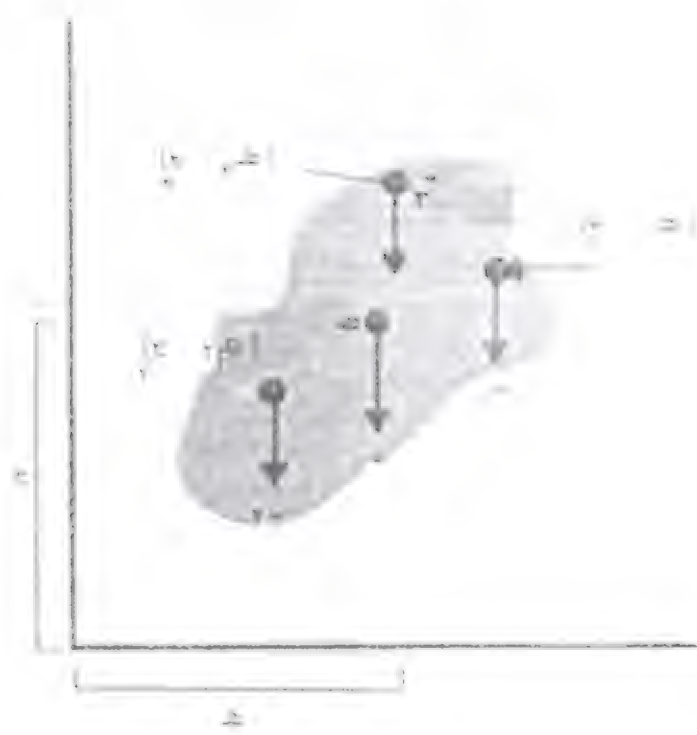
ܚܘܫܒܢܐ ܕܡܘܙܘܢܬܐ ܡܙܝܒܢܐ ܥܠܗ ܠܒܪ ܒܗܕܢܐ ܕܦܪܫܠܬܐ ܘܡܩܒܘܠܗ ܘܗܘܐ ܒܙܘܓܐ ܒܒܪܬܐ ܕܐܝܒܐ ܕܡܚܝܢܐ ܦܫܝܛܐ ܐܝܟ ܕܗܘܐ ܙܘܓܐ ܕܦܪܫܠܬܐ ܕܠܝܦܐ ܕܙܒܢܐ ܙܘܓ ܒܦܐ ܕܐܝܒܐ ܘܠܗ ܨܘܪܬܐ (٣ — ١٩) ܒܬܪ ܚܘܫܒܢܐ ܒܢܘܙܬܐ (ܒ) ܠܡܥܒܕܢܐ ܥܠ ܘܪܡܐ ܙܘܓ ܡܪܘܡܐ. ܘܟܘܠܐ ܡܚܝܢܐ ܠܚܘܫܒܢܐ ܕܡܘܙܘܢܬܐ ܒܘܐ ܦܠܓܐ ܕܟܘܦܦܐ ܕܚܕ ܡܢ ܚܝܠܘ ܒܒܥܠܬܐ ܠܡܥܒܕܢܐ ܒܢ ܗܕܘܢܗ ܚܝܠܐ ܕܟܒܝܫܗ.

(٣ — ١٢) ܡܨܥܬܐ ܕܝܘܩܪܐ ܕܓܘܫܡܐ Center of Gravity

ܟܠ ܓܘܫܡܐ ܥܒܝܕ ܡܢ ܡܢܘܬܐ ܙܥܘܪ̈ܐ ܝܬܝܪܐ ܐܝܟ ܕܡܬܬܐ ܘܝܬܝܪܐ ܐܦ ܡܙܝܒܬܐ ܥܠܗ ܙܠܝܩܘ ܡܢ ܡܢܘܬܐ ܡܢ ܒܘܠܒܐ ܢܝܟܐ ܘܒܟܠܗ ܐܢܘܬܐ ܗܘܐ ܝܘܩܪܐ ܕܓܘܫܡܐ (ܚ) ܒܙܘܓܐ ܠܡܥܒܕܢܐ ܒܘܐ ܠܡܢܘܬܐ ܕܝܘܩܪܐ ܠܡܥܒܕܢܐ ܠܚܒܝܫܗ ܚ، ܚ، ܚ٢ ܡܢܘܬܐ.

$ܡ = ܡ_1 + ܡ_2 + ܡ_3 + \ldots$

ܦܬ̈ܐ ܡܕܝܢ̈ܐ ܢܘܩܙܬܐ ܕܡܬܟܒܕܢܘܬܐ ܕܓܘܫܡܐ (ܦܘܠܛܐ ܕܢܘܩܙܬܐ ܕܡܫܚܬܗ) ܒܡܨܥܬܐ ܕܢܘܩܙܬܐ ܕܓܘܫܡܐ ܕܡܩܝܢܬܐ ܠܐ ܡܫܒܚܬܗ ܕܝܠܗ ܢܘܩܙܬܐ ܕܟܠܢ̈ܐ ܘܐܝܟ ܕܝܠܗ ܢܘܩܙܬܐ ܕܓܘܫܡܐ ܟܦܝ̈ܐ ܠܗܘ.



ܨܘܪܬܐ (٣ — ٢٠)

ܐ. ܢܣܒ (ܣ١، ܨ١)، (ܣ٢، ܨ٢) ܠܐܬܪ̈ܐ ܕܢܘܩܙܬܐ ܕܡܬܟܒܕܢܘܬܐ ܕܢܘܩܙܬܐ ܡ١، ܡ٢ ܒܢܘܩܙܬܐ ܘܢܣܒ (ܣ، ܨ) ܐܬܪ̈ܐ ܕܡܫܚܬܐ ܕܢܘܩܙܬܐ ܕܓܘܫܡܐ. ܘܟܕ ܟܦܝ̈ܐ ܡܘܬ̈ܐ ܠܚܘܫܒܢܐ ܕܕ̈ܪܐ ܚܠܦ ܚܕ ܡܢ̈ܐ ܡܟܝܠ ܐܝܟ ܚܘܫܒ̈ܢܐ ܕܡܘܬܒܐ ܚܕ ܗܘ ܡܢ̈ܐ ܘܡܬܟܠܐ ܕܚܘܫܒ̈ܢܐ ܚܕ (ܨ) ܒܨܘܪܬܐ (٣ — ٢٠) ܟܦܘܠܚ.

$ܡ_1ܣ_1 + ܡ_2ܣ_2 + \ldots = ܡܣ$

$$ܣ = \frac{ܡ_1ܣ_1 + ܡ_2ܣ_2 + \ldots}{ܡ}$$

ܘܡܬܟܠܐ ܕܚܘܫܒ̈ܢܐ ܚܕ ܡܢ̈ܐ (ܨ) ܒܨܘܪܬܐ ܗܢܐ ܟܦܘܠܚ

$$ܨ = \frac{ܡ_1ܨ_1 + ܡ_2ܨ_2 + \ldots}{ܡ}$$

ܡܫܚܬܐ ܕܢܘܩܙܬܐ ܕܟܠ ܚܕ ܡܕ̈ܒܪܢܐ ܘܡܬܚܫܒܐ ܘܚܘܫܒܐ ܢܦܠ ܒܢܘܩܙܬܐ ܕܡܫܚܬܐ ܕܡܫܚܬܗ ܘܐܦ ܡܫܚܬܐ ܕܢܘܩܙܬܐ ܕܟܠ ܚܕ ܡܦܩܢ̈ܐ ܘܡܬܚܫܒܐ ܘܡܬܚܫܒܐ ܢܦܠ ܒܢܘܩܙܬܐ ܕܡܫܚܬܐ ܕܡܫܚܬܐ ܒܟܠܚܕ ܡܢܗ.

ܬܡܪ̈ܝܢܐ

ܬ١ : ܩܪܝ ܠܡܫܝܡܘܬܐ ܕܐܢܝ ܒܡܐ ܕܠܫܡܠܝܗ :

١ . ܐܝܟ ܩܪܐ ܐܢܬ ܡܢ ܚܠܐ ܕܡܫܬܥܝܐ ܥܠ ܓܘܪܐ ܡܢ ܩܘܫܬܐ ܐܝܟ ܚܠܐ ܘܚܠܐ

٢ . ܦܝܫ ܡܕܢܐ ܚܠܐ ܠܣܘܦܐ ܕܡܝܬ ܒܬܘܦܐ ܕܩܕܝ ܚܠܐ ܐܘ ܗܕܝܕ ܒܬܘܠܐ ܘܙܘܒܢܐ ܒ

٣ — ܓܘܪܐ ܩܫܬܝܐ ܥܠܗ ܩܢܐ ܚܠܐ ܒܝ ܡܫܬܥܝܠܗ ܥܠܗ ܚܠܐ ܠܣܘܦܐ ܘܡܫܬܟܠܠܗ ܠܡܫܬܥܝܢܘܬܐ ܕܐܢܝ ܚܠܐ . ܘܚܠܐ ܠܣܘܦܐ ܦܝܫ ܡܕܢܐ

٤ — ܦܝܫܐ ܡܕܝܢܬܐ ܓܕܒܬܐ ܕܚܠܐ ܠܦܕܐܠܬܐ ܕܓܘܪܐ ܚܕܪ ܩܕܡܐ ܡܩܝܡܬܐ ܒ .... ܘܠܗ ܡܢ ܒܫܘܩܬܐ .... ܒܫܢ ܦܠܓܐ ܠܗ ܡܢ ܒܘܦܦܐ ܙܘܒܢܐ ܠ . .

٥ . ܐ . ܡܫܬܥܝܠܗ ܗܕܝ ܚܠܐ ܥܠ ܚܕ ܓܘܪܐ ܘܝܘܘܐ ܬܘܢܐ ܒܬܘܠܐ ܘܦܫܐ ܒܙܘܒܢܐ ܘܠܐ ܥܠ ܚܕ ܚܠܐ ܕܡܫܬܥܝܢܘܬܐ ܦܝܫ ܡܕܝܢܐ ܐܢܐ ܗܕܝ ܚܠܐ ܒ . .

ܬ٢ ܡܗܒ ܗܕܐ ܐܘ ܗܕܐ ، ܠܡܐ ܕܠܫܒ ܠܟܠ ܦܬ ܠܡܐ ܥܠ ܩܕܡܬܐ ܕܦܘܪܐ ܐ . ܐܝܟ

١ . ܫܒܘܩܐ ܕܫܬܝܬܐ ܕܝܕܥܬܐ ܠܦܪܘܫܐ ܒܝ ܩܢܐ ܠܗ ܡܢ ܫܒܘܩܐ ܕܫܬܝܬܐ ܕܦܕܐܠܬܐ ܠܗ .

٢ . ܚܠܐ ܕܫܬܝܬܐ ܒܝ ܓܘܪܐ ܓܡܝܪܐ ܡܫܘܚܬܐ ܬܚܠܦ ܩܢܐ ܓܗ ܦܠܘܠܘܬܐ ܡܙܘܢܐ ܠܘܩܕܐ ܕܐܢܝ ܓܘܪܐ .

٣ — ܐܝܟ ܕܡܫܬܥܝ ܚܠܐ ܥܠ ܓܘܪܐ ܠܐ ܗܠܗ ܐܢܫܬܐ ܕܬܚܠܦܐ ܐܢܫܘܬܐ ܘܡܫܬܐ ܠܗ .

٤ . ܬܕܐ ܕܩܘܐ ܡܙܝܢܬܐ ܕܠܐ ܢܦܠ ܦܘܠܓܐ ܕܩܕܐ ܚܠܐ ܘܡܘܦܠܬܝܗ ܥܠ ܚܕ ܚܠܓܐ ܕܡܫܬܥܝܢܘܬܐ .

٥ . ܥܒܘܕܐ ܕܫܢܬܐ ܥܡ ܠܘܩܒܠ ܘܩܛܝܢܐ ܡܫܚܠܦܐ ܘܗܘ ܬܘܬܒܐ ܕܝܘܡܬܐ
ܕܠܘܩܒܠ ܟܠ ܩܛܝܢܐ
٦ ـــ ܚܝܕ ܥܒܘܕܐ ܕܫܢܬܐ ܥܡ ܗܕܐ ܡܛܠܬܐ ܕܦܪܘܩܐ ܡܚܘܫܒܐ ܒܘܝܢܬܐ.

ܬ٣ : ܡܫܘܕܥ ܡܢ ܕܐܬܐ :
ܚܝܠܐ . ܦܘܠܚܢܐ ܕܚܝܠܐ . ܗܘܦܟܐ . ܢܘܗܪܐ . ܥܒܘܕܐ ܕܫܢܬܐ . ܡܩܛܠܢܘ .
ܕܝܘܡܬܐ ܕܠܘܩܒܠ .

ܬ٤ : ܕܦܘܫ ܗܠܝܢ ܠܘܩܒܠ ܠܡܢ ܕܐܬܐ :
ܐ . ܚܝܠܐ ܠܘܬܗ .
ܒ . ܚܝܠܐ ܒܪܐ .
ܓ . ܗܘܝܐ ܫܢܬܐ ܡܫܘܕܥܬܐ ܒܫܘܬܐ ܘܡܥܒܕܢܘܬܐ.
ܕ . ܗܘܝܐ ܫܢܬܐ ܡܢܚܢܬܐ .

ܬ٥ : ܕܦܘܫ:
ܐ . ܡܢܘܢ ܕܫܢܬܐ.
ܒ . ܬܪܬܝܢ ܕܬܘܒܘܬ ܝܘܠܦܢܐ ܡܫܬܥܢܝܢ.
ܓ . ܥܠܠܬܐ ܕܫܢܬܐ.
ܕ . ܬܪܬܝܢ ܡܫܕܪܝܢ ܠܬܘܒܘܬ ܝܘܠܦܢܐ.
ܗ . ܐܕܫܐ ܕܫܢܬܐ .
ܘ . ܕܝܠܝܬܐ ܕܩܛܝܢܐ ܥܒܝܕܐ ܡܢ ܓܒܪܐ ܦܫܝܛܐ.

ܬ٦ : ܡܫܘܝ ܗܕܝܪܘܬ ܦܘܓܠܡܐ ܕܐܬܐ :
ܡܩܝܡܬܐ ܥܠܘ ܕܗܘܐ ܠܘܩܒܠ ܒܬܘܒܘܬ ܝܘܠܦܢܐ ܒܡܥܒܕܢܘܬܐ ܕܗܠܝܢ ܚܝܠܐ ܐ.
ܗܘܝ ܬܘܒ ܐܘ ܠܐ ܬܘܒ.

ܬ٧ : ܐܫܟܚܬ ܫܘܝܢܐ ܕܥܒܕܐ ܕܐܠܝܢ ܓܘܫ ܫܟܝܢܐ ܚܝܠܐ ܠܘܗ ܡܥܒܕܢܐ
ܒܫܢܐ ܢܘܗܪܐ ܡܢ ܥܠܘ ܦܘܠܚܢܗ"

ܬ٨ : ܡܢܐ ܝܠܗ ܡܙܘܕܘܬܐ؟ ܘܡܢܐ ܝܠܗ ܫܘܫܠܬܐ ܡܝܬܝܢܝܬܐ ܠܗܘܡܟܬܗ. ܘܡܢܐ ܝܠܗ ܙܘܟܗ؟

ܬ٩ : ܒܫܡܝ ܘܡܢܐ ܕܡܛܝܐ ܒܠ ܗܕܐ ܕܦܕܘܠܐ ܬܦܝܓܐ ܒܠܗ ܟܡܫܘܟܐ ܡܢ ܘܟܐ. ܡܢܐ ܝܠܗ ܟܪܝܗܐ ܕܘܠܐ ܟܪܝܗܘܬܗ ܕܘܝܟ ܐܢܐ ܡܛܝܐ؟

ܬ١٠ : ܐܢܐ ܗܘܦܟ ܟܪܝܐ ܒܡܥܒܪܐ ܠܝܛܫܐ ܡܘܬܒܐ ܒܠܗ ܠܘܡܐ ܬܘܐ ܗܘܡܕܐ ܕܠܘܡܐ؟ ܠܠܝ ܠܐܗܐ ܟܕܘܡܐ.

ܬ١١ : ܡܫܡܕܬܐ ܘܟܦܐ ܡܕܟܒܬܐ ܕܟܒܕܗ ܒܠ ܐܕܟܐ ܐܘܦܡܬܐ ܕܟܘܡ ܟܠܝܗ ܚܝܠܐ ܡܟܟܕܢܐ ܒܠ ܡܕܟܒܬܐ.

ܬ١٢ : ܡܫܡܕܬܐ ܠܕܬܐ ܡܕܟܒܬܐ ܕܟܒܕܗ ܒܠ ܐܕܟܐ ܐܘܦܡܬܐ ܕܟܘܡ ܟܠܝܗ ܚܝܠܐ ܡܟܟܕܢܐ ܒܠ ܡܕܟܒܬܐ.

ܬ١٣ : ܦܝܫ ܟܝ ܚܝܠܐ ܕܫܟܬܐ ܟܬܕܘܗܝ ܬܘܐܠܐ (١٢،١١) ܐ. ܒܟܘܕܐ ܕܫܟܬܐ ܝܗܘܐ ܟܬܗ ܟܬܕܘܗܝ ܐܟܝܘܬܐ.

ܬ١٤ : ܡܫܕܟ ܘܟܬܐ ܕܫܟܬܐ ܡܘܫܝܐ ܐܟܝܘܬܐ ܕܒܫܟܬܗ ܠܗ ܫܟܬܐ ܕܡܘܕܝܐ ܘܫܟܬܐ ܕܟܕܟܬܐ

ܬ١٥ : ܐ. ܦܘܠܛܐ ܟܬܕ ܚܝܠܐ ܘܡܦܐ ܚܘܝܐ (١٠٠) ܢܘܛ. ܘܟܘܠܐ ܕܫܕ ܡܢܝܗ (٦٠) ܢܘܛ. ܫܟܝܡ ܟܘܠܐ ܕܚܝܠܐ ܕܐܢܐ ܘܙܘܟܐ ܕܦܘܠܛܐ ܠܦܘܬ ܕܝܗ؟

ܦܘܢܝܐ : ٨٠ ܢܘܛ. ٣٧

ܬ١٦ : ܡܢܐ ܝܠܗ ܚܝܠܐ ܗܟܘܢܢܐ ܠܝܛܫܐ ܠܝܢܐ ܬܟܝܟܐ ܠܢܬܗ (٣٧°) ܡܢ ܐܘܦܩܐ ܘܐܝܡܫܐ ܠܘܬܦܬܐ ܕܙܒܘܡܐ ܗܘܡܕܗ (٥٠) ܢܘܛ. ܠܟܠ ܕܝܛܫܐ ܟܡܠܘܠܘܬܐ ܡܛܘܟܫܬܐ؟

ܦܘܢܝܐ : ٣٠٠ ܢܘܛ.

ܬ١٧ ܡܢܐ ܗܘ ܚܝܠܐ ܡܫܘܝܢܐ ܠܪܘܡܐ ܐܘܩܝܢܐ ܘܐܝܢܐ ܠܡܫܚܬܐ ܕܪ̈ܬܘܡܐ ܒܪܘܡܐ ܚܡܫܐ ܠܟܠ ܕܩܝܩܐ ܒܡܠܘܠܘܬܐ ܡܬܡܨܥܬܐ؟

ܦܘܢܝܐ : ٣٧٥ ܣܘܣܝ̈ܐ

ܬ١٨ : ܦܥܠܘ ܦܠܢܐ ܢܘܩܕܐ ܚܘܝܠܗ (٢٠٠) ܣܘܣܝ̈ ܒܗܕܐ ܚܒܠܐ ܐܝܟ ܕܐܫܬܡܫ (٣ ــ ٢١) ܐܬܥܒܕ ܕܠܗܘܢܐ ܕܟܠ ܡܢ ܗܕܘܢ ܚܒܠܐ.

ܦ : ܕܠ١ = ١٦٠ ܟܓ

ܕܠ٢ = ١٢٠ ܟܓ

ܬ١٩ : ܐ. ܒܚܘܫܒܐ ܕܫܚܬܐ ܕܥܒܕܬܐ ܠܡܘܬܒܐ ܢܘܩܕܐ (٢٠٠) ܣܘܣܝ̈ ܡܘܗܒܝܢ ܟܠ ܝܘܡܐ ܐܘܩܝܢܐ ܬܘܐ ٢٠٠٠ :

ܐ. ܡܢܐ ܗܘ ܚܝܠܐ ܐܘܩܝܢܐ ܐܝܢܐ ܠܡܥܒܕܬܐ ܕܡܘܬܒܐ ܒܡܠܘܠܘܬܐ ܡܬܡܨܥܬܐ ܘܟܠ ܚܝܠܐ ܗܕܝܢܐ؟ ܦ : ٤٠ ܟܓ

ܒ. ܡܢܐ ܗܘ ܚܝܠܐ ܐܝܢܐ ܕܒܥܒܕ ܘܫܚܬܐ (٣٧) ܟܡ ܐܘܩܝܢܐ ܠܡܫܚܬܐ ܕܡܘܬܒܐ ܟܠ ܕܐܘܪܐ ܝܘܡܐ ܒܡܠܘܠܘܬܐ ܡܬܡܨܥܬܐ ܘܟܠ ܚܝܠܐ ܗܕܝܢܐ؟

ܦ : ٥٨،٨٢ ܟܓ

ܓ. ܡܢܐ ܗܘ ܚܝܠܐ ܐܝܢܐ ܕܒܥܒܕ ܘܫܚܬܐ (٣٧) ܟܡ ܐܘܩܝܢܐ ܠܡܥܒܕܬܐ ܕܡܘܬܒܐ ܟܠ ܕܐܘܪܐ ܝܘܡܐ ܒܡܠܘܠܘܬܐ ܡܬܡܨܥܬܐ ܘܟܠ ܚܝܠܐ ܗܕܝܢܐ؟

ܦ : ٤٣.٤٨ ܟܓ

ܬ٢٠ : ܐܬܥܒܕ ܚܝܠܐ ܡܚܘܝܢܐ ܠܡܘܬܒܐ ܒܝܢ ܐܝܢܐ ܠܡܫܚܬܐ ܕܪ̈ܬܘܡܐ ܢܘܩܕܐ (٣٠٠) ܣܘܣܝ̈ ܠܟܠ ܕܡܘܬܒܐ ܒܝܢ ܕܠܢܐ ܡܢ ܐܘܩܝܢܐ (٣٧) ܒܡܠܘܠܘܬܐ ܡܬܡܨܥܬܐ ܐ. ܒܚܘܫܒܐ ܕܫܚܬܐ ܕܥܒܕܬܐ ܒܗܝ ܪ̈ܬܘܡܐ ܘܡܘܬܒܐ ܗܘܐ ٢٠٠.

ܦ : ٢٢٨ ܟܓ

ܦܣܘܩܐ ܪܒܝܥܝܐ

ܢܡܘܣܐ ܕܢܝܘܬܢ ܥܠ ܙܘܥܐ ܬܪܝܨܐ

Newton's Laws In Linear Motion



4 — 1 ܐܡܝܢܘܬܐ ܘܡܘܙܓܐ ܢܗܝܐ

4 — 2 ܐܚܝܕܘܬܐ ܕܚܝܠܐ
ܟܡܘܬܐ ܘܡܘܬܪܒܐ

4 — 3 ܚܘܫܒܐ ܘܙܘܠܦܐ

4 — 4 ܥܒܕܐ ܘܗܘܦܟ ܥܒܕܐ

4 — 5 ܡܢܘ ܢܛܪܬܐ ܕܚܘܫܒܐ

4 — 6 ܠܫܘܝܬܐ ܥܠ ܡܢܘ
ܢܛܪܬܐ ܕܚܘܫܒܐ

4 — 7 ܡܢܘܢ ܕܓܒܠܐ

4 — 8 ܡܢܘ ܢܬܘܦܬܐ
ܠܡܢܝܬܐ ܕܚܘܒܝ

4 — 9 ܚܘܫܠܐ ܘܚܘܡܪܐ

4 — 10 ܚܒܝܫܬܐ ܕܚܘܫܠܐ ܕܐܪܥܐ

4 — 11 ܚܘܡܪܐ ܬܪܝܨܐ ܘܫܘ ܡܪܐ ܡܟܒܪܢܐ

ܦܫ ܡܕܝܢܬܐ ܗܘܡܣܐ ܕܗܘܠܦ ܡܚܠܝܦ ܕܟܝܢܐ ܐܣܝܘܬܐ ܟܕ ܪܘܚܐ ܕܠܘܩܒܠ
ܘܫܠܐ ܡܟܬܒܢܐ ܚܠܝܗ ܟܘܠܦ ܕܢܩܫ ܟܕ ܢܟܝܬܐ ܠܗ ܕܡܟܬܒܢܘܬܐ
ܕܫܠܐ ܚܠ ܠܘܩܒܠ ܟܕܢ ܡܟܬܒܢܐ ܟܘܫܠܦܐ ܒܐܢܟܝܘܬܗ ܘܡܟܬܬܐ. ܐܝܟ ܕܩܕܡ
ܐܝܟ ܦܫܝܢܐ ܡܢ ܪܘܚܐ ܡܢܗ ܡܢ ܡܠܘܠܘܬܐ ܡܬܟܬܐ ܘܡܢܗ ܡܢ ܡܠܘܠܘܬܐ
ܡܫܠܡܬܐ.

ܘܐܝܟ ܐܣܘܬܐ ܟܕ ܫܠܐ ܡܟܬܒܢܐ ܟܬܘܒܬܐ ܡܬܫܪܬܐ ܘܡܬܘܫܠܦܐ ܟܘܬܒܗ
ܐܘ ܐܣܘܬܐ ܕܟܬܒܢܗ ܢܘܡܬܐ ܚܕܬܐ ܠܗ ܟܬܒܗ ܟܢܟܠܐ ܦܫܝܐ ܐܠܐ ܢܘܩܒܐ
ܢܩܫ ܟܘܬ. ܗܘܐ ܡܕܝܢܐ ܕܦܫܠܗ ܡܟܬܒܢܘܬܐ ܕܫܠܐ ܟܘܢܟܐ ܕܠܘܩܒܠ
ܠܗ ܟܠܬܐ ܡܘܢܐ ܦܝܠܝܗ ܡܕܝܢܐ ܟܝܡܗ ܘܐܘܐ ܟܢܝܬܐ ١٦٨٧ ܡ.

(٤ — ١) ܩܘܫܐ ܡܕܝܢܝܐ ܕܝܘܣܦ (ܐܦܝܣܩܘܦܐ . ܡܘܪܝ ܐܕܝ)

ܫܟܠܗ ܩܘܫܐ ܡܕܝܢܝܐ ܕܝܘܣܦ. ܐܝܟ ܕܡܬܐܠܗ ܟܕ ܠܘܩܒܗ ܐܘܟܬܐ ܡܢ
ܠܟܢܝܐ) ܡܢ ܕܐܬܐ:

(ܚܠ ܠܘܩܒܠ ܦܫ ܐܢܫܐ ܟܡܠܘܠܘܬܗ ܡܬܘܡܬܐ ܘܚܠ ܫܠܐ ܟܕܝܢ ܐ.
ܐܝ ܐܠܝ ܟܫܘܟ ܡܟܬܒܢܘܬܐ ܕܫܟ ܫܠܐ ܠܫܠܦܐ ܕܐܢܟܝܘܬܗ ܘܡܟܬܐ)

ܘܐ. ܠܘܩܒܠ ܟܕܡܫܘܬܐ ܘܟܝ ܫܟܐ ܟܫܠܬܐ ܕܐܘܐ ܩܘܫܐ ܟܫܫܠܗ
ܕܠܐ ܕܟܠܗ ܟܠܘܬܐ ܕܠܘܩܒܠ ܟܕ ܠܘܩܒܠ ܟܠܐ ܦܫ ܫܟܝܐ ܗܘܢܝܐ
ܟܡܠܘܠܘܬܐ ܡܬܘܡܬܐ ܟܘܠܗ ܘܩܒܝ. ܘܡܟܬܒܢܘܬܐ ܕܫܠܐ ܠܟܘܟ
ܡܬܟܠܝܘܬܐ ܕܐܘܐ ܩܘܫܐ ܠܗ ܡܟܬܒܢܘܬܐ ܕܦܘܠܚܐ ܕܫܠܐ ܟܕܐ ܟܘܝ ܐ.
ܘܗܝ ܫܠܐ ܠܗܐ ܟܘܐ ܗܘܐ ܠܗ ܘܦܩ ܟܟܕܐ ܚܠ ܠܘܩܒܠ ܟܟܘ ܟܐܠܗ
ܟܘܠܐ ܘܦܠܗ ܟܘܦܐ ܘܡܕܦܐ ܠܡܟܬܒܢܘܬܗ ܚܠ ܠܘܩܒܠ ܟܟܗ ܘܚܠ
ܕܐܘ ܡܝܬܐ ܠܗ ܡܟܬܐ ܕܩܘܫܐ ܡܕܝܢܐ ܕܝܘܣܦ. ܟܫܠܬܐ ܟܕ ܚܠܬܐ
ܠܠܘܦܐ ܐܝܟ ܕܐܬܐ ܚܠ ܠܘܩܒܠ ܦܫ ܟܠܐ ܐ. ܗܘܐ ܟܠܐ ܘܦܫ ܗܘܢܝܐ
ܟܡܠܘܠܘܬܐ ܗܟܬܐ ܐ. ܗܘܐ ܗܘܢܝܐ ܐ. ܐܝ ܡܟܬܒ ܚܠܗ ܫܠܐ ܟܕܐ ܟܫܠܦ
ܡܢ ܐܢܟܝܘܬܗ ܘܡܟܬܐ".

ܘܡܟܬܐ ܗܘܟܬܐ ܚܠ ܟܐܫܐ ܕܦܠܚܐ ܐܘܟܬܐ ܡܢ ܦܘܩܐ ܦܫ ܠܟܠܟ
ܟܐܢܟܝܘܬܗ ܐ. ܐܝ ܡܟܬܒ ܚܠܗ ܫܠܐ ܟܕܐ ܟܫܠܦ ܐܢܟܝܘܬܗ ܘܡܟܬܐ
ܘܦܕܝܘܦܐ ܟܠܐ ܟܕܝܬܐ ܕܡܟܬܒܐ ܕܕܟܐ ܐܝܢ ܠܟܬܒܐ ܕܦܦܐ ܕܟܬܒܐ ܕܕܝܬܐ
ܠܘܩܒܠ ܗܘܫܢܐ ܦܫܟܐ ܟܫܠܘܬܗ ܐܠܐ ܐܝܢ ܠܘܩܒܠ ܟܟܬܒܐ ܕܡܠܬܐ ܕܕܝܬܐ

ܡܢ ܪܘܚܗ ܡܦܫܘܛܐ ܐܡܝܢܘܬܐ ܥܠ ܪܘܚܗ ܠܡܕܡܐ ܘܗܘܐ ܡܫܡܠܗ ܠܗ ܕܐܠܗܘܬܐ ܐܡܪ ܒܐܝܬܝܘܬܗ ܡܢ ܥܠܬܐ ܐܘ ܪܘܚܐ ܠܦܘܬ ܥܠܬܗ ܘܡܘܙܓܗ ܒܗܘ ܡܢ ܫܘܠܛܢܐ ܕܐܝܬܝܘܬܗ ܘܟܝܢܗ ܒܗܝ ܕܗܘܐ ܦܪܝܫܘ ܡܢܗ ܗܘܐ ܕܝܠܢܝܬܐ ܒܐܝܬܝܘܬܐ ܒܥܠܬܐ ܕܐܝܬܝܘܬܐ ܕܐܠܗܘܬܐ ܥܠ ܥܠܬܗ ܐ. ܗܘܐ ܥܠܬܐ ܘܠܗ ܘܡܢܗ ܐ. ܗܘܐ ܡܘܠܕܐ. ܐܦ ܦܪܫܠܗ ܡܢܗ ܗܘܐ ܕܝܠܢܝܬܐ ܒܡܘܙܓܐ ܗܢܐ ܒܗܘ ܒܗܠܝܢ ܡܘܕܐ ܠܗ ܥܠ ܪܘܚܐ ܡܢ ܗܢܐ ܐ. ܗܘܐ ܥܠܬܐ ܐܦ ܡܘܕܐ ܠܗ ܠܥܠܬܐ ܡܢ ܗܢܐ ܐ. ܗܘܐ ܡܘܠܕܐ ܐ. ܠܐ ܡܬܒܥܐ ܠܗ ܥܠܗ ܫܠܐ ܒܬܪ ܫܠܝܛ ܐܝܬܝܘܬܗ ܐܡܝܢܘܬܐ ܘܡܘܙܓܐ ܗܢܐ ܕܝܠܢܝܬܐ ܠܗ ܡܢ ܕܝܠܢܝܬܐ ܕܗܘܠܐ ܢܦܩܐ ܠܒܗܠܝܢ ܕܐܠܗܘܬܐ ܒܗܝ ܐܢܐ ܗܘܠܝܢ ܒܗܘ ܒܟ ܦܪ̈ܫܐ ܫܒܝܬܐ ܕܝܠܢܝܬܐ ܕܗܘܠܐ ܕܒܝܬܐ ܠܐܠܗܘܬܐ ܗܢܘܢ ܠܫܠܐ ܒܬܪ ܠܫܘܠܛܢܐ ܕܐܝܬܝܘܬܗ ܘܟܝܢܐ.

ܒܬܪ ܕܐܫܬܡܥ ܗܠܝܢ ܕܡܪܐ ܒܪܐ ܒܗ ܡܢ ܒܕܝܢܘܬܐ ܕܪܘܚܐ ܕܡܬܩܠܐ ܗܠܝܢ ܥܡ ܡܪܐ ܕܒܕܠ ܒܕ ܚܙܐ ܕܐܠܗܘܬܐ ܕܒܬܟܬܒ ܥܠ ܐܢܫܐ ܗܠܝܢ ܕܒܠܒ ܒܬܪ ܘܒܬܪ ܕܠܐ ܢܒܘܪܐ ܠܠܝܢ ܡܬܪܘܠܠܗ. ܐܠܐ ܒܪܬܐ ܠܗ ܕܫܠܡܐ ܕܫܪܒܬܐ ܕܐܠܗܘܬܐ ܒܬܟܬܒ ܕܒܬܟܬܒ ܥܠܗ ܘܡܘܙܝ ܕܦܘܫ ܠܘܟܗ ܠܗ ܕܡܟܠܝ ܠܐܠܗܘܬܐ ܡܘܠܕܐ. ܘܒܕ ܠܫܡܝܢܘܬܐ ܕܐܢܐ ܫܠܐ ܠܐ ܠܗ ܗܘܝܬܐ ܒܗܝ ܕܗܘܐ ܠܐ ܗܘܝܐ ܐܝܬܝܘܬܐ ܕܪܘܚܐ ܕܐܠܗܘܬܐ ܘܗܘܐ ܡܪܐ ܕܫܘܫܠܗ ܒܫܡܗ ܢܘܟܪܝܐ.

ܘܠܦܘܬ ܫܒܝܬܐ ܕܡܢܗ. ܡܪܡܐ ܕܫܘܡܗ. ܡܘܕܝܐ ܠܗ ܠܐܡܪܐ ܕܐܠܗܘܬܐ ܐ. ܗܘܐ ܥܠܬܐ ܐܘ ܡܘܠܕܐ ܒܥܠܬܢܝܬܐ ܡܬܘܡܝܬܐ ܘܡܠ ܫܘܐ ܗܪܟܐ ܘܠܐ ܕܗܘܐ ܦܘܠܓܐ ܕܫܠܐ ܒܬܪ ܡܬܒܥܐ ܥܠܗ ܒܗܘܐ ܡܦܡܐ.

(٤ — ٢) ܡܢܘܬܐ ܬܪ̈ܝܢܬܐ ܕܝܘܠܦ

(ܐܫܬܘܬܐ ܕܫܠܐ ܒܗܠܝܢ ܘܡܘܕܝܢܐ)

ܒܬܪ ܚܕ ܟܡܕ ܐ. ܗܘܐ ܦܘܠܓܐ ܕܫܠܐ ܡܬܒܥܐ ܥܠ ܠܘܬܐ ܠܐ ܒܗܘܐ ܡܦܡܐ ܕܐܝܟ ܒܗܘܢܐ ܐܝܬܝܘܬܐ ܘܟܝܢܐ ܕܐܠܗܘܬܐ؛ ܦܘܠܓܗ ܬܪܘܢܐ ܝܘܠܦ. ܥܠ ܕܗܘܐ ܒܗܠܝܢ ܒܣܬܒܬܐ ܕܡܢܘܢܗ ܬܪ̈ܝܢܐ ܕܪܘܚܐ ܒܕ ܗܘܐ ܠܐܠܗܘܬܐ ܒܐܝܬܝܘܬܐ ܕܪܘܚܐ ܒܡܘܕܝܢܐ ܡܬܒܥܢܐ ܘܡܠܘܦ ܝܘܚܢܐ ܐܬܢܣܝܘܣ ܠܒܝܘ. ܝܘܠܦ. ܬܪ̈ܝܢܐ ܡܬܡܪܚܢܐ ܡܢ ܒܬܪܗ ܠܐܢܫܐ ܒܗܠܝܢ ܒܗܘܢܐ ܒܗܠܝܢ ܘܒܢܝܐ ܕܥܠܬܢܝܬܐ؛ ܦܣܩ ܬܪܝܨܐ ܫܠܐ ܡܬܒܥܢܐ ܠܗ ܘܡܟܠ ܐܘܐ ܒܗܠܝܢ

ܒܓܘܫܡܐ ܕܡܥܒܕ ܥܠܗ ܚܝܠܐ ܘܡܣܪܗܒܘܬܐ ܕܝܠܗ ܒܟܕܒܕܐ ܕܣܘܥܪܐ ܗܕܡܐ ܕܣܘܟܐ. ܡܬܕܡܝܐ ܠܡܟܒܕܐ ܕܢܦܫܗ ܕܝܠܗ :

ܐ. ܐܢ ܢܓܕ ܚܝܠܐ ܡܫܠܛ (ܚ) ܠܓܘܫܡܐ (ܡ) ܘܡܣܪܗܒܘܬܐ ܥܠܗ ܥܠܝܗ ܒܚܘܦܪܐ ܡܬܚܘܝܢܐ ܐܝܟ ܕܒܨܘܪܬܐ (٤ — ١) ܒܗܝܕ ܚܝܠܐ ܒܬܘܪܨܐ ܡܫܚܬܐ ܘܟܢܘܫ ܗܘܐ (ܣ) ܡܬܚܙܐ ܕܡܣܪܗܒܘܬܐ ܥܠܝܗ ܡܬܒܥܝܐ ܒܫܥܬܐ ܕܟܠ ܚܕ ܡܫܘܚܬܐ (ܡ) ܘܒܪܗܛܐ ܕܘܡܝܐ (ܘ ܡܬܚܙܝܢ ܕܡܣܬܟܠ ܢܩܦܐ ܕܒܚܝܢܘܬܐ ܕܟܡܝܘܬܐ ܕܣܘܟܐ ܘܚܝܠܐ ܡܬܕܡܝܢܐ ܐܝܟ ܡܫܘܚܬܐ ܕܚܝܠܐ ܡܬܒܥܐ ܠܡܫܘܚܬܐ ܕܒܬܘܪܨܐ ܗܢܐ ܘܟܕ ܗܘܪܨܐ ܦܫܛ ܡܬܬܝܕܥ ܟܕ ܚܝܠܐ ܡܟܒܕܢܐ ܒܟܠܗ ܡܫܘܚܬܐ ܘܡܣܪܗܒܘܬܐ ܥܠܝܗ ܡܬܒܥܝܐ ܐܝܟ ܗܘܐ ܡܬܐܡܪܐ ܠܟܘܠܗ ܐܝܟܢܐ ܕܐܬܐ :

$ܣ \propto ܚ$

ܨܘܪܬܐ (٤ — ١)

ܐܦ ܒܡܬܕܡܝܢ ܢܩܦܐ ܕܒܝܬ ܒܡܣܬܪܗܒܘܬܐ ܕܚܝܠܐ ܐܚܪܝܐ ܕܣܘܟܐ ܡܣܪܗܒܘܬܐ ܒܟܘܠܗ ܘܚܝܠܐ ܡܬܕܡܝܢܐ ܐܝܟ ܕܒܬܘܪܨܐ ܕܡܬܟܒܕܠܗ ܚܝܠܐ ܡܫܘܚܬܐ ܦܫܛ ܘܦܫܝܛ ܟܕ ܚܝܠܐ ܡܬܟܒܕܐ ܒܗܘ ܚܝܠܐ ܐܚܪܐ ܕܐ. ܒܡܫܘܚܬܐ ܚܝܠܐ ܒܬܘܪ ܡܬܬܪܨܐ ܠܦܘܠܚܐ ܘܡܣܪܗܒܘܬܐ ܥܠܝܗ ܡܬܟܒܕܐ ܐܝܟ ܗܘܐ ܗܘܝܐ ܒܚܝܠܬܐ ܡܫܘܚܬܐ ܕܐܬܐ :

$ܣ \propto \frac{١}{ܡ}$

ܘܐܫܬܟܚܬ ܕܡܬܘܪܐ ܡܘܫܠܡܬܐ ܒܚܕܐ ܡܘܫܠܡܬܐ ܒܦܘܠܚܐ :

$ܣ \propto \frac{١}{ܡ}$

$ܬ = \frac{ܚ}{ܓ}$ ܟܘܝ̈ܠܐ ܡܫܚܬܐ

ܗ̈ܢܐ ܘܕܝܢ ܡܫܘܚܬ̈ܐ ܕܟܠ ܓܘܫܡܐ ܦܫܛ ܐܘܪܚܐ ܠܒܝܬ ܦܘܠܓ̈ܐ ܕܚܝ̈ܠܐ ܡܫܚܠ̈ܦܐ ܒܠܚܘܕ ܘܦܫܛܝܢ ܠܒܝܬ ܟܘܝܠܐ ܕܟܘܡܠܐ ܕܐܘܪܚܐ ܠܓܘܫܡܐ.

ܘܠܦܘܬ ܕܗܘܠܐ ܕܡܕܝܢܐ ܦܬܝܠܘ ܡܫܘܚܬܐ ܣܘܓܝ ܕܝܠܗ ܚܝܠܐ ܕܐ ܡܫܚܠܦܐ ܥܠ ܟܘܡܠܐ (١ ܟܝܠ) ܟܡܫܚܬܐ ܡܫܘܚܬܐ ܟܘܝܠܐ (١ ܡ ܕܦ ٢) ܗ̈ܢܐ ܘܕܝܢ :

$ܬ = \frac{ܚ}{ܓ}$ ← $ܚ = ܓ\,ܬ$

ܘܐܗܐ ܝܠܗ ܚܝܠܐ ܡܫܘܚܬܢܝܬܐ ܕܡܢܘ . ܐܢ̈ܫܐ ܕܣܘܓܝ.

ܘܐܝܟܢ ܕܢܦܠ ܓܘܫܡܐ ܒܫܘܪܝܐ ܚܠܦܐ ܚܝܠܐ ܡܫܚܠ̈ܦܐ ܥܠ ܟܘܡܠܐ ܕܓܘܫܡܐ ܝܠܗ ܡܘܡܐ (ܝ) ܘܓܘܫܡܐ ܢܦܠ ܒܡܫܘܚܬܐ ܟܘܝܠܗ ܡܫܘܚܬܐ ܬܪܬܝܢ (ܬ) ܘܟܪܗܐ ܗܘܐ : $ܝ = ܓ\,ܬ$ ܗ̈ܢܐ ܘܕܝܢ ܦܫܛܐ $\frac{ܚ}{ܬ}$ ܟܡܫܘܚܬܐ ܡܫܚܬܐ ܝܠܗ ܟܘܡܠܐ ܕܓܘܫܡܐ ܕܦܬ̈ܐ ܣܓܝܐܬܐ ܡܫܚܬܐ ܟܡܐ ܕܢܚܠܦ ܒܘܦܘ ܥܠ ܢܦܫܐ ܕܐܪܥܐ ܐܘ ܒܪܒܘ.

ܗ̈ܢܐ ܘܕܝܢ $\frac{ܚ}{ܬ} = \frac{ܝ}{ܬ}$

$$\frac{ܚܝܠܐ ܡܫܘܚܬܢܐ ܠܓܘܫܡܐ}{ܡܫܘܚܬܐ ܦܠܓܘܬܐ ܡܢܗ} = \frac{ܡܘܡܐ ܕܓܘܫܡܐ}{ܡܫܘܚܬܐ ܐܪܥܢܐ}$$

ܘܟܘܕ ܕܐܗܐ ܡܫܘܚܬܐ ܝܠܗ ܕܦܠܓܝܚ ܡܢ ܡܢܘ . ܐܢ̈ܫܐ ܕܣܘܓܝ . ܕܠܟܠ ܚܝܠܐ ܡܫܘܚܬܢܐ ܡܫܘܚܬܐ ܘܠܟܠ ܡܫܘܚܬܐ ܚܝܠܐ ܘܡܫܘܚܬܐ ܝܠܗ ܡܫܚܠܦܐ ܡܢ ܚܝܠܐ ܠܟܠ ܓܘ ܡܫܚܬܐ ܕܟܘܡܠܐ ܕܝܠܗ ܟܡܢܘ . ܐܢ̈ܫܐ ܕܣܘܓܝ.

ܦܝ ܡܘܕܥܢܐ ܣܘܚܪܐ ܕܝܠܗ ܒܡܫܘܚܬܐ ܕܪܘܡܐ ܕܐܝܬܠܗ ܠܗܘܡܐ ܘܫܘܐ
ܠܗ ܦܦܐ ܕܡܠܘܠܘܬܐ ܟܕ ܢܚܬܐ ܕܠܗܘܡܐ ܒܡܘܬܠܗ ܘܝܠܗ ܗܝ ܡܫܘܚܬܐ ܙܘܥܐ
ܣܘܚܪܐ = ܡ ܥ ܘܣܕܝܘܬܗ ܝܠܗ ܒܓܝܡ . ܡ/ܪܦ ܘܠܘܕܐ ܪܘܦܬܐ ܟܠ
ܦܪܘܦܐ ܒܡܠܘܠܘܬܐ ܘܒܘܪܬܐ ܡܙܝܕܬܐ ܝܠܗ ܟܪܬܗ ܒܣܘܚܪܐ ܘܟܘܪܐ ܐܠܐ
ܪܒܐ ܟܗܡܐ ܝܠܗ ܟܪܬܐ ܕܠܘܕܬܐ ܒܢܬܗ ܐ. ܦܢܠܗ ܪܘܦܬܐ ܒܡܠܘܠܘܬܐ
ܟܘܪܬܐ ܟܕ ܗܘܐ ܣܘܚܪܗ ܟܘܪܐ ܐܦ ܟܦܦ ܣܘܚܪܐ ܕܐܗܐ ܠܘܕܬܐ ܐ. ܟܦܦܠܗ
ܒܘܬܠܗ.

$$\text{ܘܒܕ ܗ} = \frac{\text{ܡ}_{2} - \text{ܡ}_{1}}{\text{ܙ}} \qquad \text{ܣ} = \text{ܥ ܗ}$$

$$\text{ܣ} = \frac{\text{ܥ}(\text{ܡ}_{2} - \text{ܡ}_{1})}{\text{ܙ}}$$

$$\text{ܣ ܙ} = \text{ܥ ܡ}_{2} - \text{ܥ ܡ}_{1}$$

ܘܦܝ ܡܕܢܐ ܦܠܛܐ ܕܟܘܦܦܐ ܕܚܝܠܐ ܘܒܢܐ ܕܡܟܟܕܢܘܬܗ ܟܠ ܠܗܘܡܐ
ܒܕܟܘܬܐ ܕܚܝܠܐ ܐܘ ܢܦܝܫܬܐ ܘܣܕܝܘܬܗ ܢܘܬ. ܪܦܦܐ ܘܗܘ ܢܘܐ ܒܘܚܠܦܐ
ܒܣܘܚܪܐ.

ܠܘܦܬܐ (١)

ܪܕܝܬܐ ܒܘܬܠܗ (١٠٠٠) ܟܓܡ ܪܕܝܐ ܒܡܠܘܠܘܬܐ ٧٢ ܟܡ ܒܫܥܬܐ ܟܠ
ܐܘܪܚܐ ܐܘܦܩܐ ܒܡܢܐ ܝܠܗ ܚܝܠܐ ܕܥܠܛܝܠܗ ܡܥܠܝܢܗ ܠܡܥܠܝܬܗ ܒܬܪ ܕܡܛܝܐ
ܡܙܝܚܘܬܐ ܒܘܬܠܗ (٨) ܡܝܬܪܐ.

ܫܪܝܐ :

$$\text{٧٢ ܟܡ ܒܫܥܬܐ} = \frac{\text{٧٢٠٠ ܡ}}{\text{٣٦٠٠ ܪܦ}} = \text{٢٠ ܡ/ܪܦ}$$

$$\text{ܡ}_{2}^{2} = \text{ܡ}_{2}^{2} + \text{٢ ܗ} \,.$$

$$\text{ܡܦܩܐ}^{2} = \text{٢٠}^{2} + \text{٢ ܗ . ٨}$$

ܬ = ٢٥ ܡ/ܪ̈ܦ٢

ܚ = ܓ ܬ

= ١٠٠٠ × ٢٥ = ٢٥٠٠٠ ܢܝܘܛܢ.

ܡܘܦܬܐ (٢)

ܚܒܠܐ ܕܩܝܡܐ ܥܒܪ ܠܥܠ ܒܓܝܓܠܬܐ ܬܠܝܬܐ ܦܢܝܬܗ ܐܚܪܬܐ ܬܠܝ ܡܘܩܘ ܕܡܐܣܐ (١٠) ܟܝܠܘ ܘܒܦܢܝܬܐ ܐܚܪܬܐ ܕܡܐܣܐ ܐܚܪܬܐ ܕܡܬܠܗ (٦) ܟܝܠܘ ܐܝܟ ܕܒܐܣܟܡܐ (٤ — ٢).

١ — ܚܫܘܒ ܡܘܪܘܒܐ ܕܡܘܙܓܐ ܡܘܒܠܢܝܬܐ.

٢ — ܚܫܘܒ ܠܬܟܬܐ ܒܡܘܦܐ ܕܝܠܐ.

ܥܒܘܕ ܕܡܐܣܐ ܕܝܠܐ ܘܠܓܝܓܠܬܐ ܘܚܒܠܐ.

ܐܣܟܡܐ (٤ — ٢)

ܦܢܝܐ

ܟܕ ܠܓܝܓܠܬܐ ܥܒܝܕܐ ܠܗ ܕܠܘܚܐ ܕܝܠܐ ܥܠ ܡܘܦܘ ܒܘܢܐ ܠܗ ܘܥܒܘܕ ܗܘܐ ܕܢ ܢܘܚܝ ܘܟܕ ܡܘܩܕܐ ܕܡܐܣܐ (٦) ܟܝܠܘ ܬܝܬ ܬܚܘܬܐ ܠܗ ܡܢ ܡܘܩܕܐ ܕܡܐܣܐ (١٠) ܟܝܠܘ ܬܡܢ ܕܐܗܐ ܙܘܥܐ ܕܘܝܐ ܕܡܐܣܐ (٦) ܟܝܠܘ ܠܥܠ ܐܠܐ ܙܘܥܐ ܕܘܝܐ ܕܡܐܣܐ (١٠) ܟܝܠܘ ܠܬܚܬ.

ܚ = ܓ ܬ

ܕܠ − ٦ × ٩٫٨ = ٦ ܬ

ܚ٢ ܕܠ − ܓ٢ ܬ (٢)

(١٠ × ٩٫٨) ܕܠ − ١٠ ܬ

ܘܒܬܪܟܢ ܕܦܪܫܘܢ ܡܘܩܠܢܬܐ ܠܥܠ ܢܦܩܝܢ ܒܡܢܝܢ ܥܠ

ܬ = ٢٫٤٦ ܡܛܪ/ܪ̈ܦ٢

ܕܠ = ٧٣٫٣٧٥ ܢܝܘܛܢ.

(٤ — ٤) ܢܡܘܣ ܢܛܝܪܘܬܐ ܕܚܝܠܐ (ܥܒܕܐ ܘܗܘܦܟ ܥܒܕܐ)

ܗܕܐ ܡܘܕܥܐ ܥܠ ܫܘܚܠܦܐ ܕܦܠܚܘܬܐ ܐܘܟܝܬ ܘܟܠܗ ܚܝܠܐ ܕܢܡܘܣܗ ܠܗܢܐ ܦܬ ܡܕܝܢ ܐܝܟ ܚܝܠܐ ܕܥܒܕܐ ܐܠܐ ܘܟܕ ܫܘܚܠܦܐ ܕܦܠܚܘܬܐ ܠܗܕܢܐ ܒܗܘ ܚܝܠܐ ܠܗܢܐ ܒܗܘ ܚܝܠܐ ܕܢܛܝܪܐ ܕܗܕܢܐ ܠܗ ܒܗܘܝܐ ܘܦܠܚܗ ܒܝܘܡܐ ܘܢܦܠ ܗܕܘܢܗ ܥܠ ܫܘܚܠܦܐ ܗܕܝܢ ܘܟܠܐ ܫܘܝܐ ܕܗܕܘܢܗ ܚܝܠܐ ܡܥܒܕܝ ܥܠ ܗܕܝ ܠܓܘܫܡܐ ܦܕܝܪܐ ܘܥܒܕܐ ܗܠܝܢ ܗܘܝܐ ܕܗܕܢܐ ܡܫܥܒܕܠܗ ܥܠ ܫܘܚܠܦܐ ܕܦܠܚܘܬܐ ܐܠܐ ܗܘܦܟ ܥܒܕܐ ܗܠܝܢ ܚܝܠܐ ܕܫܘܚܠܦܐ ܕܦܠܚܘܬܐ ܥܠ ܗܕܢܐ ܘܥܒܕܐ ܘܗܘܦܟ ܥܒܕܐ ܗܕܝ ܚܝܠܐ ܡܫܬܠܡܢܐ ܠܗ ܒܝܕ ܗܕܘܢܗ ܠܓܘܫܡܐ.

ܡܫܬܥܒܕܠܗ ܕܦܪܝܫܐ ܢܡܘܣ ܥܠ ܕܐܘܪܐ ܒܕܝܡܘܬܐ ܘܡܢ ܕܡܫܠܗ ܒܡܢܘܢܗ ܗܠܝܢ ܕܝܘܡܢܐ ܘܐܘܪܐ ܙܢܝܗ، ܠܟܠ ܥܒܕܐ ܗܘܦܟ ܥܒܕܐ ܫܘܠܛܗ ܒܗܘܝܐ ܘܦܠܚܗ ܒܝܘܡܐ ܘܢܦܠ ܥܠ ܚܕ ܫܘܝܐ ܕܡܫܬܥܒܕܢܘܬܐ ܘܡܥܒܕܝ ܥܠ ܗܕܝ ܠܓܘܫܡܐ ܦܕܝܪܐ، ܒܗܘ ܕܐܘܪܐ ܚܝܠܐ ܕܗܘܦܟ ܥܒܕܐ ܠܐ ܗܠܝܢ ܗܘܝܐ ܠܚܝܠܐ ܕܥܒܕܐ ܒܗܝ ܠܐ ܡܥܒܕܝ ܥܠ ܚܕ ܠܓܘܫܡܐ ܘܡܘܠܕܗ ܠܐ ܫܘܐ ܗܟܝܠ ܡܕܪܫܬܐ ܒܗܕܝܢ ܕܝܘܡܢܐ ܠܓܘܫܡܐ ܫܘܚܠܦܐ ܡܢ ܦܠܚܘܬܗ ܡܫܬܠܡܢܐ ܠܐܕܫܐ ܘܟܠܐ ܠܐܕܫܐ ܠܗܕܐ ܐܠܐ ܫܘܚܠܦܐ ܕܐܕܫܐ ܘܟܕ ܠܫܘܚܠܦܐ ܕܦܠܚܘܬܐ ܡܫܬܠܡܢܐ ܠܐܕܫܐ ܠܓܘܫܡܐ ܚܝܠܐ ܫܘܐ ܠܗ ܐܝܟ ܗܘܦܟ ܥܒܕܐ ܘܝܠܕܐ ܕܪܡܐ ܠܓܘܫܡܐ ܒܗܘ ܕܐܘܪܐ ܚܫܡ ܘܝܠܕܐ ܕܪܡܐ ܥܠ ܐܕܫܐ ܘܡܢܝܢܐ ܫܒܝܠܐ ܒܟܠܗܝܢ ܕܠܡܘܬܐ ܕܗܘܦܟ ܥܒܕܐ ܕܐܕܫܐ ܥܠ ܫܘܚܠܦܐ ܕܦܠܚܘܬܗ.

(٤ — ٥) ܢܡܘܣ ܢܛܪܬܐ ܕܡܘܫܚܐ

Conservation Law of Momentum

ܐ. ܡܫܬܥܒܕܠܗ ܠܓܘܫܡܐ ܒܡܠܐܗ (ܓ) ܘܡܠܘܠܘܬܗ (ܡ1) ܒܚܝܠܐ ܕܥܒܕܐ ܒܡܠܐܗ (ܣ) ܥܠ ܠܓܘܫܡܐ ܐܚܪܢܐ ܒܡܠܐܗ (ܓ) ܘܡܠܘܠܘܬܗ (ܡ1) ܠܓܘܫܡܐ ܐܚܪܢܐ ܒܡܥܒܕ ܠܗܘܐ ܢܡܘܣ ܬܠܝܬܝܐ ܕܢܝܘܛܢ ܥܠ ܠܓܘܫܡܐ ܡܘܕܐ ܒܚܝܠܐ (−ܣ) ܗܘܐ ܘܟܕ ܕܡܫܬܥܒܕܢܘܬܐ ܕܐܢܐ ܗܕܝ ܚܝܠܐ ܚܕ ܡܢ ܒܗܘ ܗܘܐ (ܙ) ܕܦܩܐ ܘܐ. ܦܬܠܗ ܡܠܘܠܘܬܐ ܕܠܓܘܫܡܐ ܡܘܕܐ ܒܗܕ ܡܫܬܥܒܕܢܘܬܐ ܕܗܕܘܢܗ ܚܝܠܐ ܒܢܝܢܗ (ܡ2) ܘܦܬܠܗ ܡܠܘܠܘܬܐ ܕܠܓܘܫܡܐ ܐܚܪܢܐ ܒܗܕ ܡܫܬܥܒܕܢܘܬܐ

ܕܬܪ̈ܘܝܗ ܚܝܠܐ (ܡ٢) ܒܡܣܠܦܐ ܒܣܘܥܝܐ ܠܐܪܘܚܗ ܒܡܐܠܐ ܦܠܓܐ ܕܡܚܦܬܐ
ܚܠܝܡ (ܫ ܙ) ܗܘܐ ܠܓܘܫ ܕܘܡܠܝܬܐ ܠܗܝܐ:

ܫ١ = ܡ٢ ܥ٢ − ܡ١ ܥ١ ܠܓܘܫܡܐ ܩܕܡܝܐ

ܫ٢ = ܫ٢ ܥ٢ − ܡ١ ܥ١ ܠܓܘܫܡܐ ܬܪܝܢܐ

ܘܒܕ ܫ = − ܫ

(ܡ٢ ܥ٢ − ܡ١ ܥ١) / ܙ = − (ܡ٢ ܥ٢ − ܡ١ ܥ١) / ܙ

ܡ١ ܥ١ + ܡ١ ܥ١ = ܡ٢ ܥ٢ + ܡ٢ ܥ٢

ܗܢܐ ܘܒܝܢ ܒܘܢܝܐ ܕܣܘܥܝܐ ܩܕܡ ܠܢܩܫܬܐ = ܒܘܢܝܐ ܕܣܘܥܝܐ ܒܬܪ ܠܢܩܫܬܐ.

ܘܐܗܘܐ ܦܝܫ ܩܝܡܐ ܒܡܢܗ. ܢܛܝܪܬܐ ܕܣܘܥܝܐ ܚܛܝܬܐ ܕܫܚܝܢ (ܦܝܫ ܒܘܢܝܐ ܡܘܠܝܐ ܠܣܘܥܝܐ ܕܓܘܫܡܐ ܡܐܝܬܐ ܒܡܢܐ ܕܒܪܐ ܒܝܢܬܝܗ ܡܢ ܚܒܪܐ ܘܗܘܦܟ ܚܒܪܐ ܐ، ܠܐ ܡܚܒܒ ܚܠܝܡ ܚܝܠܐ ܒܪܝܐ).

ܡܬܠܐ

ܓܘܠܐ ܒܡܐܠܗ (١،٠) ܟܝܠܘ ܘܡܠܘܠܗܬܗ (٢٠٠) ܡܝܬܪ\ܪܦ ܠܢܩܫܗ ܒܩܘܪܬܐ ܐܘܦܣܬܐ ܒܡܛܠܬܐ ܡܢ ܡܫܐ ܒܡܐܠܗ (١،٩) ܟܝܠܘ ܡܘܬܒܐ ܥܠ ܦܬܟܬܐ ܐܘܦܣܬܐ ܚܢܝܢܬܐ ܘܡܝܠܗ ܓܗܘ. ܐܫܟܚ ܡܠܘܠܗܬܐ ܕܡܫܐ ܒܬܪ ܠܢܩܫܬܐ ܕܓܘܠܐ ܒܗ ܐܨܛܠܐ (٤ — ٣).



ܐܨܛܠܐ (٤ — ٣)

ܥܢܝܢܐ

ܡ١ ܥ + ܡ١ ܥ = ܡ٢ ܥ + ܡ٢ ܥ

ܟܕ ܗܘܠܝ ܥܒܝܠܘ ܒܡܛܠܝܐ ܕܡܫܩܐ ܒܚܕ ܕܐܘܐ ܩܠܘܠܘܬܗܘܢ ܒܬܪ ܠܥܩܬܐ

ܣܕܪܐ ܒܠܗ ܘܥܒܕܘܗ ܫܚܠܦ ܒܠܗ (ܡ) ܒܗܘܝܐ : ܡ١ ܥ + ܡ١ ܥ = ܡ ܥ + ܡ ܥ

٢٠٠ × ٠،١ + ܩܠܝܠܐ × ١،٩ = ܡ (٠،١ + ١،٩)

ܡ = ١٠ ܡܝܛܪ \ ܪܦ

(٤ — ٦) ܠܫܡܫܬܐ ܕܠ ܩܢܘܡ ܬܠܝܬܝܐ ܕܫܘܩܢܐ

ܐ. ܦܬܠܘ ܡܫܢܐ ܠܗܠܝ ܫܘܩܢܐ ܕܠܗܠܠܐ ܠܡܕܡܐ (ܡ، ܥ)، ܥܗܐ ܫܘܩܢܐ ܕܐܢܕܐ ܘܡܛܠܐ ܠܬܚܬܐ (− ܡ٢ ܥ٢) ܐܝܟ ܗܘܦܟ ܒܚܕܐ ܕܠܗ ܠܐ ܘܡܠܠ ܕܐܘܐ ܐܗܐ ܝܘܡܐ ܕܙܕܘܫܐ ܘܛܫܝܬܐ ܢܦܘܩܐ ܦܠܫ ܒܠ ܐܗܐ ܕܩܢܘܡ. ܬܠܝܬܝܐ ܕܫܘܩܢܐ (ܬܠܝܬܝܐ ܕܡܫܘܬܐ ܕܘܝܠܬܐ) ܘܐܝܟ ܕܦܬܝ ܪܘܦܐ ܐܢܐ ܙܕܘܫܐ ܐܘ ܛܫܝܬܐ ܢܦܘܩܐ ܒܚܒܕܐ ܕܡܫܘܩܐ ܡܢ ܒܘܬܠܗܘ (ܗܘܦܐ ܝܡܝܕܐ) ܠܬܚܬܐ ܒܩܠܘܠܘܬܐ ܡܡܫܚܬܐ ܗܘܦܟ ܒܚܕܐ ܗܘܐ ܒܠ ܛܫܝܬܐ ܐܘ ܙܕܘܫܐ ܠܡܕܡܐ ܒܡܫܘܬܐ ܕܘܡܠܐ ܥܗܐ ܠܡܫܘܬܐ ܕܗܘܦܐ ܡܕܘܦܐ. ܠܠܢܐ ܡܠܘ ܡܢ ܕܐܘܐ ܕܙܕܘܫܐ ܠܐ ܘܝܟ ܦܠܛܐ ܕܚܒܕܐ ܡܬܘܬܦܐ ܒܢ ܐܢܐ ܗܘܦܐ ܘܡܕܘܒܢܐ ܢܕܢܐ ܡܢ ܐܢܕ ܘܡܛܠܘܕܐ ܢܦܘܩܐ ܦܠܫ ܒܐܢܒܫܘܬܐ ܒܢ ܛܒܥܐ ܠܗ ܕܡܝܬܐ ܢܕܢܐ ܩܠܝܠܐ ܡܢ ܒܗܘܝܐ ܕܦܘܫܐ.

ܛܘܦܣܐ

ܙܕܘܫܐ ܕܦܐ (١٢٥٠) ܒܠܘܛܪܡܐ ܡܢ ܫܘܡܕܝܐ ܒܫܒܕ ܕܦܦܐ ܒܩܠܘܠܘܬܐ ܒܘܢܠܗ ٥٠٠٠٠ ܡܝܛܪܐ \ ܪܦܦܐ ܐܫܟܠܐ (٤ — ٤). ܒܡܐ ܡܠܘ ܫܠܐ ܕܘܝܟ ܒܗ ܙܕܘܫܐ ܠܡܕܡܐ؟

ܥܢܝܢܐ

ܒܕ ܩܠܘܠܘܬܐ ܕܕܡܫܬܐ ܕܗܘܦܐ ܡܕܢ ܡܢܕܗܘܢ = ܩܠܝܠܐ ܘܩܠܘܠܘܬܗܘܢ

ܐܫܟܠܐ (٤ — ٤)

ܟܹܐ ܡܸܢܕܝܵܢ ܘܕܦܢܝܵܢ = ٥٠٠٠٠ ܡܲܚܬܵܐ ܪܦ

ܘܒܪ ܣ ܘ = ܦ (ܡ٢ ܡ١)

ܣ × ١ = ١٢٥٠ (٥٠٠٠٠ ـ ܗܦܡܐ)

ܣ = ٦٢٥٠٠٠٠٠ ܢܘܛ.

ܐܗܐ ܚܝܠܐ ܠܥܠܐ ܦܠܛ ܡܢܗ ܘܗܘܝܐ ܚܝܠܐ ܬܘܬܐ ܠܗ ܠܡܦܪܚܐ ܡܢܟܝܢ ܠܡܦܪܚܐ ܕܛܪܘܚܐ ܠܡܦܪܚܐ

ܗܹܠܝܼܟܘܿܦܬܹܪ Helicopter

ܠܗܹܠܝܼܟܘܿܦܬܹܪ ܗ̇ܝ ܡܲܪܟܘܼܒܬܵܐ ܡܕܡܝܬܐ ܦܪܚܬܐ ܘܐܚܪܢܬܐ ܕܘܒܪܬܐ ܐܝܟ ܒܨܘܪܬܐ (٤ — ٥) ܘܡܪܟܘܒܬܐ ܡܕܡܝܬܐ ܡܢ ܦܠܐ ܡܢܝܢܬܐ ܠܗ ܠܥܠܡܝܢܬܐ ܕܘܝܬܐ ܕܦܠܛܗ ܚܕܐ ܗܕܐ. ܐܠܐ ܦܪܦܠܬܐ ܕܡܪܟܘܒܬܐ ܘܗܘܝܬܐ ܕܠܥܠܬܐ ܕܬܘܬܐ ܕܦܪܦܠܬܗ ܬܠܬܐ ܕܗ ܡܕܪܐ ܦܪܦܠܬܐ ܐܚܪܝ ܕܗ ܐܝܟ ܦܪܐ.

ܘܦܠܛ ܡܢ ܦܪܦܠܬܗ ܚܝܠܐ ܕܡܘܪܡܐ ܥܠܗ ܡܪܟܒܬܗ ܘܗܦܟܐ ܦܝܕ ܡܕܡܐ ܬܚܝܠܐ ܡܪܡܝܢܐ Lift ܥܒܕ ܠܡܪܡܝܬܐ ܕܠܡܥܠܝܐ ܕܦܪܚܬܐ ܠܥܠܠ. ܘܡܪܟܒܬܗ ܐܘܦܫܐ ܦܝܕ ܡܕܡܐ ܬܚܝܠܐ ܕܘܚܦܬܐ Thrust ܥܒܕ ܥܠ ܡܪܟܝܬܐ ܕܦܪܚܬܐ ܐܘܦܫܝܗ. ܐܦ ܡܥܒܕ ܥܠ ܦܪܚܬܐ ܚܝܠܐ ܕܝܘܩܪܗ (ܝ) ܘܡܦܫܝܗ ܠܗܘܐ ܘܚܝܠܐ ܡܥܪܩܠܬܐ ܠܘܩܒܠ ܦܝܕ ܡܕܡܐ ܬܚܝܠܐ ܕܦܩܣܬܐ Drag.

ܨܘܪܬܐ (٤ — ٥) ܓܘܢܝܐ ܦܪܚܬܐ ܦܪܚܬܐ ܕܗܠܝܟܘܦܬܪ

ܡܠܘܠܐ ܕܡܪܘܚܬܐ ܕܛܝܣܬܐ ܕܥܠܥܘܦܐ ܡܬܚܬܐ ܠܗ ܘܡܫܠܛܢܐ ܕܪܘܦܐ ܕܦܐ ܠܚܕ ܙܘܥܐ ܕܛܝܣܬܐ ܕܥܠܥܘܦܐ ܘܡܬܡܘܬ ܝܘܠܗ ܘܐܝܟ ܕܗܘܝܐ ܛܝܣܬܐ ܦܪܚܐ ܒܐܐܪ Hovering ܘܒܐܝܢܘܬܐ ܕܡܬܡܘܬ ܝܘܠܐ ܗܘܝܐ ܐܝܢܘܬܐ ܕܡܪܘܚܬܐ ܪܡܬܐ ܐܘܦܩܬܐ ܘܟܕ ܚܝܠܐ ܦܠܛܐ ܡܢ ܦܪܐܠܬܗ ܗܘܐ ܫܘܘܝܐ ܠܠܗ ܒܘܟ ܕܐܗܘܐ ܗܘܐ ܚܝܠܐ ܕܝܩܪܬܐ + ܚܝܠܐ ܕܡܪܘܡܬܐ = ܝܘܩܪܐ ܕܛܝܣܬܐ + ܚܝܠܐ ܕܡܦܚܬܐ ܐܝܟ ܡܚܘܝܐ ܒܨܘܪܬܐ (٤ — ٦) ܘܐܝܟ ܕܗܘܝܐ ܛܝܣܬܐ ܡܬܚܪܟܬܐ ܠܩܕܡܐ ܐܘ ܠܒܣܬܪܐ ܒܡܠܘܠܐ ܡܛܠܥܬܐ ܦܪܐ ܠܝܐ ܡܢ ܐܘܦܩܐ ܒܙܘܝܬܐ ܡܬܚܒܬܐ ܘܗܘܐ ܚܝܠܐ ܦܠܛܐ ܡܢ ܙܘܓܐ ܫܘܘܝܐ ܠܠܗ ܘܡܪܟܒܗ ܙܘܓܐ (ܚܝܠܐ ܕܡܪܘܡܬܐ ܘܐܘܦܩܬܐ) ܚܝܠܐ ܕܝܩܪܬܐ) ܦܠܚ ܟܠ ܙܘܥܐ ܕܛܝܣܬܐ ܒܙܘܥܐ ܛܠܝܩܐ ܐܝܟ

ܚܝܠܐ ܕܝܩܪܬܐ = ܝܘܩܪܐ ܕܛܝܣܬܐ

ܘܚܝܠܐ ܕܝܩܪܬܐ – ܚܝܠܐ ܕܡܦܚܬܐ

ܐܝܟ ܡܚܘܝܐ ܒܨܘܪܬܐ (٤ — ٧)

ܨܘܪܬܐ (٤ — ٦)

ܨܘܪܬܐ (٤ — ٧)

ܐܠܐ ܐܝܟ ܕܐܡܪܢ ܛܘܦܣܐ ܠܟܠ ܒܘܪ̈ܘܢܐ ܡܛܠܡܐ ܣܠܩܐ ܕܡܪܡܝܬܐ ܗܘܐ ܒܒ ܪܒܐ ܡܢ ܚܘܫܒܐ ܕܛܘܦܣܐ ܐܠܐ ܡܪܘܚܬܐ ܕܘܢܒܬܐ ܦܠܢܐ ܒܟܠ ܡܟܠܬܐ ܕܛܘܦܣܐ ܡܢ ܦܪܠܬܐ ܚܕ ܢܩܫܘ ܐܝܟ ܗܘܦܟ ܒܒܪܐ ܕܡܪܘܚܬܐ ܒܢܒܬܐ ܐܦ ܦܠܢܐ ܟܠ ܡܢܒܬܐ ܕܙܘܥܐ ܕܦܪܚܬܗ.

(٤ — ٧) ܩܢܘܢ̈ܐ ܕܟܦܠܪ

ܕܟܦܠܪ ܪܒܐ ܡܢ ܦܠܣܘܦܐ ܐܠܡܢܝܐ ܘܡܘܡܟܢ ܡܕܡܢܐ ܘܡܪ̈ܒܝܐ ܘܬܠܡܝܕܗ ܡܢ ܡܕܡܢܐ ܕܡܬܒܠ ܘܡܢܐ ܕܒܘܚܢܐ ܘܦܠܢܝܐ ܘܬܘܩܦܗ ܠܗ ܬܝܟܘ ܘܡܢܐܠܗ ܡܕܡܢܐ ܕܟܦܠܪ ܕܐܝܬ ܗܘܐ ܠܗܠܦ ܩܢܘܢܐ ܡܢ ܕܒܘܩܘܬܐ ܕܙܘܡܢܐ ܕܦܠܢܝܐ ܘܡܘܬܒܠܗ ܬܠܬܐ ܩܢܘ̈ܢܐ ܬܝܟܘ ܘܡܢܐ ܕܒܘܚܢܐ ܬܝܟܘܬܐ ܕܡܘܡܬܐ ܦܬܠܗ ܡܢܐ ܬܝܟܘ:

ܩܢܘܢܐ ܩܕܡܝܐ (ܟܒ ܡܢܐ ܣܕܡܐ ܠܗܐ ܒܫܡܫ ܕܒܕܘܒܐ ܒܟܬܒܐ).

(ܦܪܬܐ ܒܠ ܦܠܢܝܐ ܣܪܕ ܬܝܟܢܐ ܠܗ ܒܕܘܒܢܐ ܒܟܬܒܐ ܢܦܠܐ ܬܝܟܢܐ ܒܣܕ ܡܢ ܒܟܘ)

ܩܢܘܢܐ ܬܪܝܢܐ (ܘܦܝܬ ܡܢܐ ܒܫܡܫ ܬܚܘܡܬܐ).

ܡܬܚ ܬܪܝܨܐ ܡܢܢܐ ܒܝܢ ܬܝܟܢܐ ܘܒܠ ܦܠܢܝܐ ܬܚܘܡܬܐ ܬܘܡܐ ܒܙܒܢܐ ܬܘܡܐ) ܐܝܟ ܡܘܚܘܢܐ ܒܨܘܪܬܐ (٤ — ٨) ܗܘ. ܡܬܒܠܠܗ ܦܠܢܝܐ ܡܢܘܬܐ (ܐ ܒ) ܒܙܒܢܐ (ܙ) ܘܡܬܒܠܠܗ ܡܢܘܬܐ (ܓ ܕ) ܒܙܒܢܐ ܒܟܬܗ (ܙ) ܬܚܘܡܬܐ ܐ ܒ ܡ = ܬܚܘܡܬܐ ܓ ܕ ܡ

ܩܢܘܢܐ ܬܠܝܬܝܐ (ܩܢܘܢܐ ܕܙܒܢܐ ܕܕܘܪܬܐ)

(ܡܪܒܥܐ ܕܙܒܢܐ ܕܕܘܪܬܐ ܕܟܠ ܦܠܢܝܐ ܣܪܕ ܬܝܟܢܐ ܦܝܫ ܬܐܡܝܢܐ ܥܡ ܡܩܦܠܐ ܕܒܘܥܕܐ ܕܦܠܢܝܐ ܡܢ ܬܝܟܢܐ).

$ܙ^{٢} \propto ܦܡ^{٣}$ ܒܕ ܦܡ ܝܠܗ ܡ ܪܚܩܐ ܕܒܘܥܕܐ ܕܦܠܢܝܐ ܡܢ ܬܝܟܢܐ.

$$\frac{ܦܡ^{٣}}{ܙ^{٢}} = ܒܘܢܐ$$

ܗܢܐ ܐܡܪ = ܒܘܢܐ ܡܫܘܚܬܐ ܠܟܠܗ ܦܠܢܝܐ ܕܦܪܕܠܝ ܣܪܕ ܬܝܟܢܐ.

$$= ٣٫٣١ \times ١٠^{١٨} \quad \frac{ܡ^{٣}}{ܪܦ^{٢}}$$ ܡܢ ܒܘܥܕܐ ܐܪܥܢܝܐ

(٤ — ٨) ܩܢܘܢ ܢܓܕܐ ܬܘܢܝܬܐ ܕܢܝܘܛܢ

ܡܢ ܡܠܘܐܐ ܢܕܝܟܐ ܕܦܠܝܛܐ ܬܦܠ ܠܒܘܪܐ ܡܬܚܙܝܐ ܣܡܘܟ ܬܚܝܬܐ ܐܦ ܡܘܕܐ ܦܬܐܠ ܣܡܘܟ ܐܪܥܐ ܒܒܘܪܝܐ ܡܕܝܢܐ ܘܠܐܪܥܐ ܢܦܠ ܒܝܘܡܐ ܕܡܢܝܬܗ. ܕܐܪܥܐ ܡܘܕܥܐ ܐ. ܦܬܠܗ ܬܚܘܐ ܣܕܪܐ ܕܝܘܡܐ. ܡܕܡ ܘܠܐ ܦܪܝܫܐ ܚܝܠܐ ܕܢܓܕܐ ܒܝܢ ܐܢܐ ܦܠܝܛܐ ܐܘ ܠܐܪܥܐ ܠܗܕܐ ܕܝܘܡܗ ܘܐܢܐ ܚܝܠܐ ܠܐ ܠܝܗ ܦܠܝܛܐ ܕܡܫܬܐ ܕܐܢܐ ܠܐܪܥܐ ܐܝܟ ܣܕܪܐ ܐܠܐ ܡܟܒܝܢ ܡܢ ܒܘܟܪܐ ܦܪܝܫܐ ܘܡܬܒܚܠܗ ܢܕܘܟܐ ܢܝܘܛܢ. ܒܫܢܬܐ ١٦٨٦ ܡ ܚܬܠܐ ܡܢܘܬܢܝܬܐ ܕܐܘܐ ܚܝܠܐ ܘܡܘܚܬܠܗ ܒܫܢܘ. ܦܬܠܗ ܡܢ ܒܬܚܘ ܘܡܚܒܪ (ܚܝܠܐ ܕܢܓܕܐ ܡܬܚܠܦܢܐ ܒܝܢ ܟܠ ܬܪܝܢ ܓܘܫܡܐ ܐܘ ܒܪܢܫܐ ܦܝܫ ܡܬܚܠܦ ܥܡ ܦܠܝܛܐ ܕܓܘܫܡܐ ܕܩܘܡܬܗ ܘܦܝܫ ܡܬܚܠܦ ܥܡ ܡܪܒܥܐ ܕܪܘܚܩܐ ܒܝܢ ܡܨܥܬܝܗܘܢ ܕܬܪܘܝܗܘܢ ܓܘܫܡܐ).

$$ܚ = ܗܡ \frac{ܓ_{١}\ ܓ_{٢}}{ܪ^{٢}}$$

ܟܕ (ܚ) ܚܝܠܐ ܕܢܓܕܐ ܒܝܢ ܦܓܪܝܗ ܓܘܫܡܐ ܓ١ ، ܓ٢.

(ܪ) ܪܘܚܩܐ ܒܝܢ ܡܨܥܬܝܗܘܢ ܕܝܘܩܪܐ ܕܓܘܫܡܐ

(ܗܡ) ܗܡܝܢܐ ܕܢܓܕܐ ܬܘܢܝܬܐ ܕܢܝܘܛܢ = ٦،٦٧ × ١٠ $^{-١١}$ ܢܝܘ . ܡܬܪ^{٢} \ ܟܓܡ^{٢}

(٤ — ٩) ܓܘܫܡܐ ܘܝܘܩܪܐ Mass and Weihrt

ܓܘܫܡܐ ܕܐܪܥܐ ܐܠܐ ܐܝܬܘ ܡܫܘܚܬܐ ܕܓܘܫܡܐ ܕܐܝܬ ܒܗܘܐ ܐܪܥܐ ܘܐܝܬܘ ܡܫܘܚܬܐ ܗܡܝܢܬܐ ܠܐ ܡܫܬܚܠܦܐ ܒܡܫܬܚܠܦܢܘܬܐ ܕܕܘܟܐ ܕܐܪܥܐ ܟܠ ܡܬܚܫܒܐ ܕܐܪܥܐ ܐܘ ܟܠ ܢܘܗܪܐ ܐܚܪܢܝܐ ܐܝܟ ܒܪܢܫܐ ܒܗܘܢ ܕܐܘܐ ܐܝܬܘ ܕܐܝܬܘܗ ܡܢ ܕܐܝܬܘܗ ܕܓܘܫܡܐ ܘܐܝܬܘ ܡܫܘܚܬܐ ܕܝܘܩܪܐ ܝܕܝܥܐ ܕܐܪܥܐ ܘܦܝܫ ܒܟܠܐ ܒܫܒܝܠܘܬܐ ܒܠܘܚܕܗ ܘܐܝܬܘ ܓܘܫܡܐ ܕܡܫܬܐ ܡܢ ܢܫܝܡܬܐ ܕܦܠܛܝܢ ܐܪܒܥܘܗ ܡܬܦܪܫܐ ܠܗ ܒܝܬ ܒܠܘܡܐ ܕܡܫܝܢ ܡܘܕܥܐ ܡܢ ܦܪܝܫ ܘܗܘ ܕܐܝܬܘܗ ܓܘܫܡܐ ١٠٠٠ ܟܓܡ^{٣} ܡܢ ܡܝܐ ܢܩܠܐ ܒܕܪܓܐ ٤° ܡ ܡܘܕܥܢܐ ܘܐܝܟ ܓܘܫܡܐ ܕܐܪܥܐ ܒܠܘܠܘܬܐ ܡܪܝܢܐ ܠܡܠܘܠܘܬܐ ܕܒܘܕܐ. ܦܝܫ ܡܘܕܥܐ ܝܘܩܪܐ ܕܐܪܥܐ

ܚܝܠܐ ܕܡܬܓܕܐ ܕܐܪܥܐ ܠܟܘܬܠܐ ܚܝܘܦܐ ܕܡܫܚܬܗ. ܕܐܪܥܐ ܘܟܕ ܚ = ܟ ܬ
ܬܟܕ ܕܐܘܐ ܚܝܠܐ ܕܡܬܓܕܐ ܕܠܘܩܒܠ ܟܠܕ ܐܪܥܐ ، ܘܗܝ ܘܟܕ ܢܘܩܕܘ ܬܚܠܐ
ܠܟܘܬ ܬܚܠܬܐ ܕܬܟܪܘܟܐ ܘܗܘܐ ܟܕ ܕܟܐ ܠܟܕ ܬܘܠܝܐ ܗܘ ܠܟܕ ܚܝܠܐ
ܕܬܘܢܬܐ ܟܗܝ ܬܘܠܝܐ ܟܕ ܡܕܝܢܐ ܢܠܝܗ ܠܡܫܚܬܗ. ܕܐܪܥܐ ܗܝ ܚܝܠܐ
ܕܬܘܢܬܐ. ܐܦ ܢܘܩܕܐ ܕܟܠ ܠܟܘܬܐ ܟܠ ܬܥܠܐ ܕܐܪܥܐ ܟܕ ܕܟܐ ܢܠܗ ܗܘܘ ܟܠ
ܬܥܠܐ ܕܗܘܝܐ ܟܗܝ ܗܡܕܘܟܐ ܕܢܬܘܦܬܐ ܕܗܘܕܐ ܟܕ ܘܟܘܕ ܢܠܗ ܗܝ
ܗܡܕܘܟܐ ܕܢܬܘܦܬܐ ܕܐܪܥܐ.

ܘܡܢܝܢܬܐ ܢܠܗ ܡܢܕܝܬܐ ܕܢܘܩܕܐ ܕܠܟܘܬܐ ܕܢܠܗ ܚܝܠܐ ܕܬܠܝܠܘ ܠܟܘܬܐ ܝܠܕܐ ܟܠ ܡܕܐ ܕܡܟܠܐܠܘ ܗܝ ܢܦܠܬܐ ܚܕܬܐ ، ܘܡܦܩܐ.

(٤ — ١٠) ܚܘܫܒܢܐ ܕܟܘܬܠܐ ܕܐܪܥܐ

ܬܦܕ ܝܕܥܬܐ ܕܟܘܬܠܐ ܡܝܬܝܐ ܠܬܚܘܬܐ ܕܬܬܦܬܐ ܠܘܩܒܠܬܐ ܕܢܘܝܐ. ܗܝ = ٦٫٦٧ × ١٠ $^{-١١}$ ܢܘܝܐ. ܡܬܪܐ^{٢} ܟܝܠܘ^{٢} ܘܟܕ ܢܘܩܕܐ (١) ܟܝܠܘ ܗܝ ܟܠ ܘܦܠܐ ܟܠ ܬܥܠܐ ܕܐܪܥܐ ܘܫܚܠܐ ܕܦܬܢܘܬܐ (٤٥) ܬܗܘܐ ٩٫٨ ܢܘܝܐ. ܘܬܘܚܕܐ ܬܗ ܬܥܠܐ ܕܐܪܥܐ ܘܡܫܚܬܗ. ܕܢܘܩܕܘ ܢܠܗ ܦܠܓܐ ܕܡܫܚܬܗ ܕܢܠܗ (٦٣٨٠) ܟܡ ܘܐܝ. ܚܫܒܠܗ ܟܘܬܠܐ ܕܐܪܥܐ = ܟ٢ ܟܝܠܘ ܘܟܕ

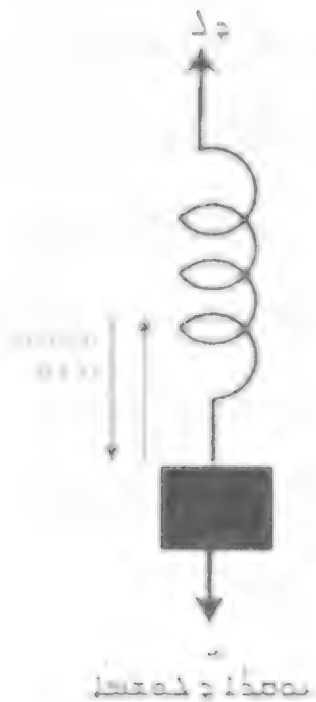
$$\text{ܚ} = \text{ܬܓ} \; \frac{\text{ܟ}_{١}\,\text{ܟ}_{٢}}{\text{ܡ}^{٢}} \qquad\qquad \text{ܟ}_{١} \times \text{ܬ} \; \frac{\text{ܟ}_{١}\,\text{ܟ}_{٢}}{\text{ܡ}^{٢}}$$

$$١ \times ٩٫٨ = ٦٫٦٧ \times ١٠^{-١١} \times \frac{١ \times \text{ܟ}_{٢}}{(٦٣٨٠ \times ١٠٠٠)^{٢}}$$

ܘܡܢܗ ܡܬܚܫܒ ܟܘܬܠܐ ܕܐܪܥܐ ܟ٢ = ٥٫٩٨ × ١٠ ^{٢٤} ܟܝܠܘܓܪܡ

(٤ — ١١) ܝܘܩܪܐ ܫܪܝܪܐ ܘܝܘܩܪܐ ܡܥܒܕܢܐ

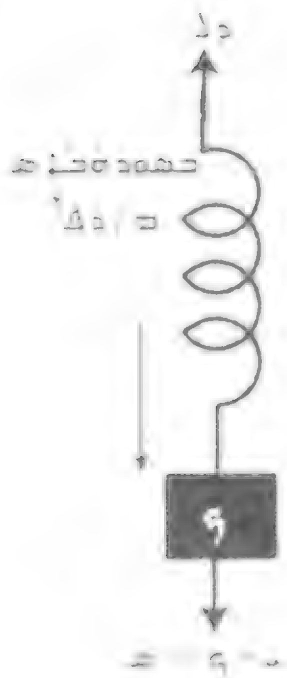
Real and Effective Weight



ܨܘܪܬܐ (٤ — ٩)

ܝܕܥܠܢ ܕܝܘܩܪܐ ܫܪܝܪܐ ܠܓܘܫܡܐ ܝܠܗ ܚܝܠܐ ܕܢܓܕܬܐ ܕܐܪܥܐ ܠܓܘܬܠܗ ܘܟܕ ܟܝܠܢܐ ܒܡܘܙܢܐ ܕܩܕܡܬܐ ܕܠܒܟܐ ܕܡܘܩܪܐ ܚܠܘܙܝܬܐ ܡܚܘܝܢܐ ܠܝܟܐ ܕܡܠܬܐ ܕܝܘܩܪܐ ܐܠܐ ܡܘܩܪܐ ܠܐ ܟܝܠ ܝܘܩܪܐ ܫܪܝܪܐ ܕܓܘܫܡܐ ܐܡܝܢܐܝܬ ܘܐܢ ܦܫܠܗ ܬܠܝܐ ܓܘܫܡܐ ܒܡܘܙܢܐ (ܓ) ܒܡܘܩܪܐ ܚܠܘܙܝܬܐ ܡܣܘܬܬܐ ܒܐܪܥܐ ܕܡܣܩܬܐ ܘܡܣܩܬܐ ܝܗܘܐ ܒܠܢܐ ܐܘ ܣܠܩܬܐ ܐܘ ܢܚܬܬܐ ܒܬܠܘܠܝܘܬܐ ܣܦܝܩܐ ܣܘܪܗܒܐ ܡܥܒܕܢܐ ܠܓܘܫܡܐ ܒܬܠܝܘܬܐ ܐܡܝܢܬܐ ܟܘܐ ܣܦܝܩܐ ܘܟܕ ܝ = ܓ ܣ ܘܡܢ ܨܘܪܬܐ (٤ — ٩) ܒܚܙܝܢ :

$$ܕܠ - ܝ = ܓ \times ܣܦܝܩܐ$$



ܨܘܪܬܐ (٤ — ١٠)

$$ܕܠ - ܝ = ܣܦܝܩܐ$$

$$ܕܠ = ܝ$$

ܗܢܐ ܘܕܝܢ ܡܚܘܝܐ ܕܡܘܩܪܐ = ܝܘܩܪܐ ܫܪܝܪܐ ܕܓܘܫܡܐ = ܓ ܣ

ܐܢܐ ܐܝ ܡܣܩܬܐ ܗܘܐ ܢܚܬܬܐ ܒܣܘܪܗܒܐ ܡܫܚܬܐ ܘܟܡܝܘܬ ܗܘܐ (ܣ) ܡܝܬܪ / ܪܦ² ܐܝܟ ܒܨܘܪܬܐ (٤ — ١٠) ܘܟܕ ܝ = ܓ ܣ

ܫ − ܕܠ = ܩ ܬ

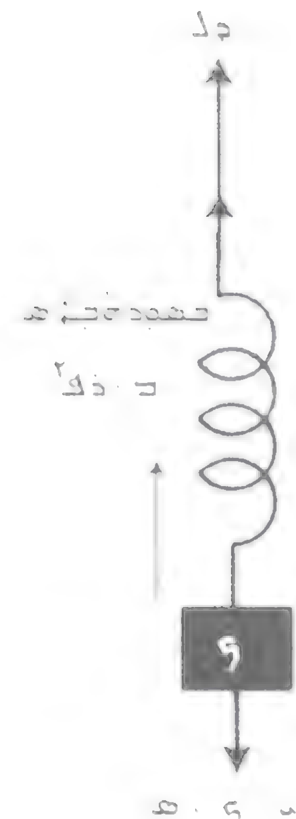
ܕܠ = ܫ − ܩ ܬ

ܗܢܐ ܘܕܝܢ ܡܥܢܐ ܕܡܘܩܪܐ (ܬ) ܝܠܗ ܢܘܡܪܐ ܡܚܬܒܢܐ ܕܠܘܬܡܐ ܘܝܠܗ ܒܝܕ ܬܪܘܨܐ ܡܢ ܢܘܡܪܗ ܫܪܝܪܐ ܒܡܘܢܟܐ (ܩ ܬ) ܐܠܐ ܐܝ ܡܚܡܝܢܐ ܗܘܐ ܢܫܡܐ ܚܐܪܐ ܒܚܘܪܗܒܐ ܐܪܟܢܐ (ܬ) ܒܗܘܐ :

ܫ − ܕܠ = ܩ ܬ

ܕܠ = ܫ − ܩ ܬ

= ܩ ܬ − ܩ ܬ = ܣܦܝܪܐ



ܨܘܪܬܐ (٤ — ١١)

ܐܠܐ ܐܢ ܗܘܐ ܠܘܬܡܐ ܡܠܡܢܐ ܒܚܘܪܗܒܐ ܡܚܠܘܬܐ ܘܬܒܘܬ ܗܘܐ ܬ ، ܡܟܕܐ ܕܦ² ܐܝܟ ܒܨܘܪܬܐ (٤ — ١١) ܘܒܕ ܫ = ܩ ܬ

ܫ − ܕܠ = ܩ ܬ

ܕܠ = ܫ + ܩ ܬ

ܗܢܐ ܘܕܝܢ ܡܥܢܐ ܕܡܘܩܪܐ ܬ ܝܠܗ ܢܘܡܪܐ ܡܚܬܒܢܐ ܕܠܘܬܡܐ ܘܝܠܗ ܒܝܕ ܪܒܐ ܡܢ ܢܘܡܪܗ ܫܪܝܪܐ ܒܡܘܢܟܐ (ܩ ܬ)

ܠܐܝܘܩܪܐ ܕܝܘܩܪܐ Weightlessness

ܐܝܢ ܪܓܫܝܢ ܒܝܘܩܪܢ ܒܗܝ ܥܠܡܐ ܕܟܠܝܢ ܟܠܗ ܡܘܠܕ ܚܝܠܐ ܙܘܪܐ ܠܟܠ ܟܠ ܐܢܫܐ. ܦܠܓܐ ܕܡܬܚܡܐ ܕܐܢܫܐ. ܠܗ ܘܐܢܟ ܒܗܘܝܢ ܒܡܚܡܝܢܐ ܪܫܡܐ ܒܢ ܒܚܘܪܗܒܐ ܡܬܚܙܐ ܒܪܓܫܝܢ ܒܘܝܕܐ ܕܚܝܠܐ ܕܡܬܚܡܐ ܕܥܠܡܐ ܕܡܚܡܝܢܐ ܠܐܢܫܐ. ܡܢ ܡܐ ܕܗܘܐ ܟܠܗ ܥܠܡܐ ܘܒܐܗܐ ܪܓܫܝܢ ܕܗܘܝܢ ܒܢ ܡܕ ܝܘܩܪܐ ܐܝ. ܝܗܠܗ ܡܚܡܝܢܐ ܒܚܘܪܗܒܐ ܡܬܚܙܐ ܘܬܪܝܢ ܚܝܠܐ ܕܡܬܚܡܐ ܕܥܠܡܐ ܕܡܚܡܝܢܐ ܠܐܢܫܐ. ܘܒܐܗܐ ܪܓܫܝܢ ܕܗܘܝܢ ܒܢ ܬܪܘܨܐ ܕܝܘܩܪܐ ܘܐ. ܡܚܡܝܢܐ ܗܘܐ

ܢܗܪ̈ܐ ܒܡܘܪܗܒܐ ܐܪ̈ܥܐ (ܣ) ܠܐ ܗܘܐ ܠܝܠܚ̈ܐ ܕܡܣܡܢ̈ܐ ܐܦܝܕ ܚܝܠܐ ܕܦܢ̈ܐ
ܥܠ ܐܡܠܟ. ܘܕܠܫܚ ܒܐܚܝܢܘܬܐ ܕܠܐܝܘܬܐ ܕܝܘܡܢܐ ܐܦ ܕܐܗܐ ܚܫܠܬܐ ܠܗ
ܦܝܣܬܐ ܐܠܐ ܠܐ ܠܗ ܒܕܝܩܬܐ ܡܢ ܠܒܒܐ ܦܝܫܐ ܒܒ ܠܐ ܗܘܝܐ ܠܒܝܬܘܬܐ
ܕܝܘܡܢܐ ܐܠܐ ܐ. ܗܘܐ ܡܣܬܘܒܐ ܐܪ̈ܥܬܐ ܡ - ܡܦܩܐ ܒܗ. ܝܘܡܢܐ ܕܠܘܚܡܐ ܠܗ
ܚܠܐ ܕܢܬܦܬܐ ܕܐܪ̈ܥܐ ܠܗ

ܐܠܐ ܒܕܝܡܘܬܐ ܕܠܐܝܘܬܐ ܕܝܘܡܢܐ ܠܦܘܬ ܡܕܒܒܢܘܬܐ ܕܡܠܟܐ ܠܗ
ܦܠܝܛܘܬܐ ܡܢ ܗܘܝܬܐ ܕܡܕܒܒܢܘܬܐ ܘܡܠܟܘ ܐܡܝܢܐܝܬ ܒܐܚܝܢܘܬܐ ܕܢܦܠܬܐ
ܚܕܬܐ ܒܝܘܡ̈ܐ ܕܒܘܫܬܐ ܐܪ̈ܥܬܐ.

ܫܘ̈ܐܠܐ

ܒ ١ : ܐܡܪ ܠܡܘܢܐ ܐܬܒܝܙܐ ܒܥܠ ܡܢ ܡܐ ܕܐܬܐ :

١ — ܐܝܟܢ ܕܒܝܬ ܠܡܕܝܢܐ ܒܡܫܪܝܘܬܐ ܒܗܘܐ :

ܐ . ܒܡܠܟܗ ܘܐܝܬ ܐܡܝܪܬܐ   ܒ . ܐܘܟܠܘܣܗ ܘܟܕ ܐܡܝܪܬܐ

ܓ . ܡܕܒܪܢܘ ܥܠ ܡܫܪܝܘܬܐ ܐܪܥܢܐ   ܕ . ܐܝܟ ܕܡܐ ܚܝܠܐ ܡܫܒܚ ܥܠܘ.

٢ . ܐ. ܡܬܟܬܒܠܗ ܚܝܠܐ ܡܕܝܢܬܐ ܥܠ ܠܡܕܝܢܐ ܡܢ ܒܗܠܐ ܡܕܝܢܬܐ ܦܘܠܚܢܘ ܡܢܘ ܐܬܝܬܐ ܕܝܘܡ؟ ܡܬܩܪܐ ܡܢ ܡܬܟܫܦܐ :

ܐ . ܥܘܦܐ ܕܠܡܕܝܢܐ   ܒ . ܐܘܟܠܘܣܐ ܕܠܡܕܝܢܐ

ܓ . ܡܫܪܝܘܬܐ ܕܠܡܕܝܢܐ   ܕ . ܦܠܘܠܘܣܐ ܕܠܡܕܝܢܐ

٣ . ܗܫܐ ܐܡܪ ܡܟܬܒܢܝܬܐ ܚܝܠܐ ܕܢܚܬ ܠܗܫܐ ܘܐܝܟ ܨܦܪ ܠܡܕܝܢܐ ܥܠܘ ܚܝܠܐ :

ܐ . ܕܡܟܬܒ ܒܗ ܗܫܐ ܥܠ ܡܟܬܒܢܝܬܐ.

ܒ . ܕܡܟܬܒܐ ܒܗ ܡܟܬܒܢܝܬܐ ܥܠ ܗܫܐ.

ܓ . ܕܡܟܬܒ ܒܗ ܗܫܐ ܥܠ ܐܪܥܐ.

ܕ . ܕܡܟܬܒܐ ܒܗ ܡܟܬܒܢܝܬܐ ܥܠ ܗܫܐ.

٤ . ܚܝܠܐ ܕܟܬܒܬܐ ܘܗܘܦܟ ܟܬܒܐ ܠܦܘܡ ܡܢܘ ܐܬܝܬܐ ܕܝܘܡ؟ :

ܐ . ܦܠܚ ܥܠ ܠܡܕܝܢܐ ܒܢܝܗ   ܒ . ܦܠܚ ܥܠ ܐܬܪܗ ܠܡܕܝܢܐ ܡܬܚܠܦܐ

ܓ . ܗܘܝ ܥܘܢܐ ܒܥܘܢܝܐ ܘܠܐ ܡܠܝܫ ܥܠ ܚܕ ܚܝܠܐ ܕܡܟܬܒܢܘܬܐ.

ܕ . ܠܐ ܗܘܝ ܥܘܢܐ ܒܥܘܢܝܐ ܘܠܐ ܡܠܝܫ ܥܠ ܚܕ ܚܝܠܐ ܕܡܟܬܒܢܘܬܐ.

٥ . ܚܝܠܐ ܕܚܟܡܬܐ ܒܝܢ ܐܬܪܐ ܦܬܓܡܐ ܡܘܬܒ ܒܐ ܠܐ ܐܬܠ ܥܠ :

ܐ . ܚܝܠܐ ܠܡܘܬܒܐ ܕܚܠܦ ܒܗ ܚܕ ܡܢܗܘܢ ܥܠ ܐܚܪܢܐ.

ܒ . ܦܬܓܡܘܬܐ ܕܐܬܘܢ ܦܬܓܡܐ ܡܘܬܒܐ.

ܓ . ܒܗܝ ܐܬܘܢ ܦܬܓܡܐ ܦܠܓܐ ܡܠܝܫ ܐܘ ܒܐܬܟܢܘܬܐ ܕܪܘܚܐ ܩܕܝܫܬܐ.

ܕ . ܒܗܝ ܕܐܬܘܢ ܦܬܓܡܐ ܡܘܕܥܐ ܡܠܝܫ ܐܘ ܠܐ.

٦ . ܐܝܢܐ ܕܠܐܬܐ ܗܕܐ ܠܓܘܫܡܐ ܙܘܝܐ ܒܡܘܬܠܐ. ܙܘܠܦܐ ܒܡܘܫܚܐ ܟܠܢܝܐ:

ܐ . ܡܢܝܢ ܟܠ ܩܠܘܠܘܬܐ ܕܓܘܫܡܐ ܠܟܝܦܐ.

ܒ . ܡܢܝܢ ܟܠ ܘܝܬܐ ܕܠܐܬܐ ܒܗ ܡܢܘܚܝ ܓܘܫܡܐ.

ܓ . ܙܘܐ ܦܫܝܛܐ.

ܕ . ܡܢܝܢ ܟܠ ܦܐܬܐ ܝܘܒܠܐ ܠܟܠ ܓܘܫܡܐ ܠܟܝܦܐ.

٧ . ܟܠ ܓܘܫܡܐ ܒܐܝܬܝܗܘܬܐ ܕܩܠܘܠܘܬܐ ܡܢܝܢ ܕܗܘܐܠܗ :

ܐ . ܩܠܘܠܘܬܐ ܒ . ܡܘܫܚܐ

ܓ . ܦܘܬܝܐ ܘܪܘܡܐ ܕ . ܦܘܬܝܐ ܥܡܝܩܐ

٨ . ܐܝܢܐ ܕܦܬܝܬܐ ܩܠܘܠܘܬܐ ܕܓܘܫܡܐ. ܟܦܝܦ :

ܐ . ܫܘܕܗܒܗ ܒ . ܡܘܫܚܗ

ܓ . ܦܘܬܝܗ ܘܪܘܡܐ ܕ . ܦܘܬܝܗ ܥܡܝܩܐ

٩ . ܗܘ ܕܠܐ ܙܒܠܦ ܠܗ ܠܟܝܦܐ ܕܗܕܐ ܓܘܫܡܐ ܐܘ ܡܢܝܢ. ܒܠܗ :

ܐ . ܡܘܫܚܐ ܕܟܠ ܓܘܫܡܐ.

ܒ . ܦܘܬܝܐ ܘܪܘܡܐ ܕܟܠ ܓܘܫܡܐ.

ܓ . ܡܘܫܚܐ ܟܠܢܝܐ ܕܟܠܝܗ ܓܘܫܡܐ ܠܟܝܦܐ.

ܕ . ܦܘܬܝܐ ܘܪܘܡܐ ܕܟܠܝܗ ܓܘܫܡܐ ܠܟܝܦܐ.

ܫ٢ : ܡܬܘܪܬܐ ܒܘܬܠܗ (١٠) ܦܬܐ ܡܫܬܐ ܦܬܐ ܡܬܘܪܐ ܒܘܬܠܗ (٥٠) ܦܬܐ ܡܫܬܐ ܒܡܫܘܚܬܐ ٣ ܡܫܬܐ ܕܦ٢ ܟܡܐ ܠܗ ܡܫܘܚܬܐ ܐܝܢ ܕܠܕܬܐ ܐܘܐ ܡܬܘܪܬܐ ܡܬܘܪܐ ܒܘܬܠܗ (٨٠) ܦܬܐ ܡܫܬܐ ܐܝܢ ܕܡܫܘܚܬܐ ܣܠܩܐ ܒܬܗ ؟

ܦ : (٢) ܡܫܬܐ ܕܦ٢

ܫ٣ : ܦܬܠܗ ܡܫܬܐ ܓܘܫܡܐ ܒܘܬܠܗ (١٥) ܒܝܬ ܟܠ ܝܘܡܐ ܐܘܦܬܐ ܬܡܬܐ ܒܣܠܐ ܐܘܦܬܐ ܒܘܬܠܗ ٧٫٥ ܣܘܬ. ܟܡܐ ܠܗ ܡܣܩܘܬܐ ܕܡܬܠܠܗ ܓܘܫܡܐ ܬܬܪ (١٠) ܕܩܦܐ ܡܢ ܙܘܢܗ ؟

ܦ . ٢٥ ܡܫܬܐ ܒܙܘܒܐ ܕܣܠܐ

ܫ٤ : ܐܢ ܦܪܘܩܐ ܕܚܙܝܐ ܒܨܘܪܬܐ (٤ — ١٥) ܩܝܡ ܒܫܠܝܐ ܟܡܐ ܗܝ
ܚܝܠܐ ܕܫܘܦܬܐ ܘܟܡܐ ܗܘ ܡܫܘܚܬܐ ܕܬܠܐ ܡܢ ܦܪܘܩܐ ܠܓܘܫܡܐ ،

ܨܘܪܬܐ (٤ — ١٢)

ܫ٥ : ܠܓܘܫܡܐ ܡܫܩܠܗ (٩٨٠) ܢܝܘܛ. ܐܝܬ ܒܥܠܬܐ ܫܩܝܠܐ ܕܡܬܬܪܐ
ܐܝܟܢ ܗܘܦܟܐ ܕܠܓܘܫܡܐ ܐܢܗ ܕܗܘܐ ܕܠܥܠ ܕܢܬܠܐ ١٠٠٠ ܢܝܘܛ. ؟
٩٠٠ ܢܝܘܛ.؟ ܦ : ٠،٢ ܡܝܛܪ/ܪܦ² ܠܥܠܠ، ٠،٨ ܡܝܛܪ/ܪܦ² ܠܬܚܬ

ܫ٦ : ܦܪܘܩ ܡܫܘܚܬܐ ܠܓܘܫܡܐ ܥܠ ܫܛܝܚܐ ܕܡܨܠܐ ܒܙܘܝܬܐ ٣٧ ܥܡ ܐܘܦܩܐ
ܐܝ ܡܚܘܬܐ ܕܫܘܦܬܐ ܒܝܢ ܠܓܘܫܡܐ ܘܫܛܝܚܐ ٠،١ ܟܡܐ ܗܘ ܗܘܦܟܐ ܕܢܬܠܐ ܠܗ
ܠܓܘܫܡܐ ܟܕ ܢܚܬ ܒܙܘܝܬܐ. ܦ : ١،٥ ܡܝܛܪ/ܪܦ²

ܫ٧ : ܬܠܘܬܐ ܟܠܗ ܘܐܢܐ ܕܐܝܬ ܠܗ (٩٨٠٠٠) ܢܝܘܛ. ܢܚܬ ܘܡܬܩܪܒ
ܒܗܘܦܟܐ ٣ ܡܝܛܪ/ܪܦ². ܟܡܐ ܗܘ ܚܝܠܐ ܕܬܠܐ ܕܐܚܕ ܠܗ ܐܢ
ܕܢܚܬ ܘܡܬܩܪܒ ܒܗܘܦܟܐ (٢) ܡܝܛܪ/ܪܦ² (ܫܒܘܩ ܠܗܘܢܐ ܕܫܘܦܬܐ)؟
ܘܗܘܐ ܡܢ ܫܘܝܐ ܚܝܠܐ ܥܠܝܐ ܕܫܘܦܬܐ (ܣ) ܢܝܘܛ. ܐܢ ܐܝܬ ܠܐܪܥܐ.
ܦ : ٤١٥٢٥ ܢܝܘܛ.

ܫ٨ : ܡܛܪܘܚܬܐ ܡܫܩܠܗ (١٠٠) ܟܝܠ ܩܝܡܐ ܠܡܬܚܬܐ ܥܠ ܫܛܝܚܐ
ܐܘܦܩܝܐ ܚܕܘܬܐ ܡܚܘܬܐ ܕܫܘܦܬܐ ٠،٢ ، ܢܬܠܐ ܠܗ (٤٠٠) ܢܝܘܛ.

ܠܐ̈ܢܐ ܡܢ ܟܘܢܐ ܐܘܦܩܝܐ ܕܙܘܝܬܐ ܕܡܝܠܗ̇ (٣٧°). ܚܫܘܒ ܠܗ̇ ܡܫܝܢܘܬܐ
ܕܡܫܬܠܡܠܗ ܡܫܟܚܢܘܬܐ ܠܗ ١٠ ܕܩܝ̈ܩܐ ܡܢ ܙܒܢܐ ܕܝ ܐܘܠܗ̇

ܦ : ٨٦ ܡܝܬܪ̈ܐ

ܬ٩ : ܠܗ ܙܒܢܐ ܕܥܡܠܗ (٤٠) ܩܠܝܡ ܡܘܥܒܕܐ ܥܠ ܟܢܫܐ ܐܘܦܩܝܐ ܚܕܘܬܐ ܠܚܘܕܐ ܕܫܚܠܗ ܠܗ ܠܟܘܪܐ (٢٠٠) ܦܘܬܠܗ ܐܝܟܐ ܩܠܝܡܐ ܕܟܘܪܐ ܥܠ ܠܥܠܝܐ ܟܠܝܬܐ ܘܥܠܝܐ ܠܗ ܡܢ ܗܘܦܐ ܟܒܫܐ ܕܠܚܕܐ ܟܒܫܐ ܠܟܘܪܐ ܐܚܪܢܐ ܕܥܡܠܗ ١٠ ܩܠܝܡ ܚܫܘܒ ܠܗ ܫܘܘܝܬܐ ܕܡܫܝܠܗ ܐܟܘܡ ܠܟܘܪܐ ܠܗ (١٠) ܕܩܝ̈ܩܐ ܡܢ ܙܒܢܐ ܕܝܘܠܦܢܐ.
ܦ : ١٩،٦

ܬ١٠ : ܩܛܝܬܐ ܕܥܡܠܗ (١٥٠٠) ܩܠܝܡ ܫܩܠܐ ܟܠܡܘܠܡܬܐ ٧٢ ܟܡ ܟܡ ܠܡܫܝܚ ܒܐܘܪܚܐ ܐܘܦܩܝܐ. ܚܫܘܒ ܩܘܘܬܐ ܡܫܝܢܘܬܐ ܕܡܢܝܐ ܠܩܛܝܬܐ ܕܡܫܬܠܡܠܗ ܡܢ ܙܡܢܐ ܐܝܟ ܢܩܫܬܐ ܕܫܚܦܬܐ ܕܫܢܝܬܐ ܐܢ ܠܩܛܐ ܕܩܛܝܬܐ ܘܐܘܪܚܐ ܟܘܐ (٠,٣).
ܦ : ٦٨ ܡܝܬܪ̈ܐ

ܬ١١ : ܦܬܟܠܗ ܡܘܥܒܕܐ ܡܫܠܛܐ ܕܝܘܪܐ ܥܠ ܓܦܝܬܐ ܐܘܦܩܝܬܐ :
ܐ. ܚܫܘܒ ܠܗ̇ ܙܘܝܬܐ ܕܠܛܝܬܐ ܕܓܦܝܬܐ ܕܟܕܐ ܡܫܠܛܐ ܕܝܘܪܐ ܟܬܒܢܒܠܬܐ

$$\text{ܠܚܝܫ. ܐܢ ܫܚܦܬܐ ܕܫܢܝܬܐ ܕܟܘܦܐ} = \frac{١}{\sqrt{٣}}$$

ܦ : ٣٠°

ܒ. ܚܫܘܒ ܠܗ ܗܘܕܘܟܐ ܕܡܝܕ ܟܗ ܡܫܠܛܐ ܕܝܘܪܐ ܟܡܗܝܐ ܕܟܬܒܢܒܠܬܗ ܠܗ ܦܬܝܬܐ ܕܙܘܝܬܐ ܕܠܛܝܬܐ ܕܓܦܝܬܐ ܗܘܝܬܐ ܐܝܟ ܢܩܫܬܐ ܕܫܚܦܬܐ ܕܫܢܝܬܐ ܕܟܬܒܢܒܠܬܐ = ٠،٢
ܦ : ٣،٢ ܡܝܬܪ̈ܐ

ܬ١٢ : ܠܘܠܐ ܕܥܡܠܗ (٢٠) ܩܠܝܡ ܟܕܐ ܟܠܡܘܠܡܬܐ ܐܘܦܩܝܬܐ ܕܥܡܠܗ (٣٠٠) ܡܝܬܪ̈ܐ. ܠܟܦܠܗ ܟܚܫܐ ܗܝܠܐ ܕܗܠܐ ܘܦܫܪܠܗ ܠܗܘ ܡܫܝܢܘܬܐ (١٥) ܗܡ ܐܢ ܟܘܪܐ ܕܝܗܠܐ ܠܦܘܠܐ ܝܗܘܐ ܗܘܝܬܐ ܚܫܘܒ ܠܗ ܥܡܠܗ.
ܦ : ٦ × ١٠[٣] ܝܘܠ.

ܦܣܘܩܐ ܚܡܝܫܝܐ

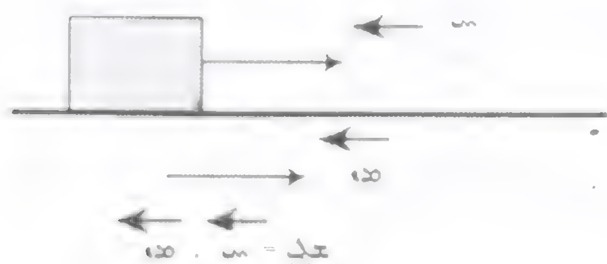
ܥܒܕܐ ܘܚܝܠܬܐ ܘܬܘܩܦܐ

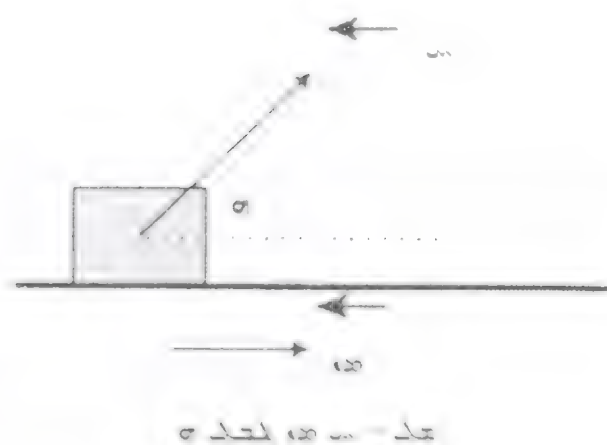
Work , Power and Energy

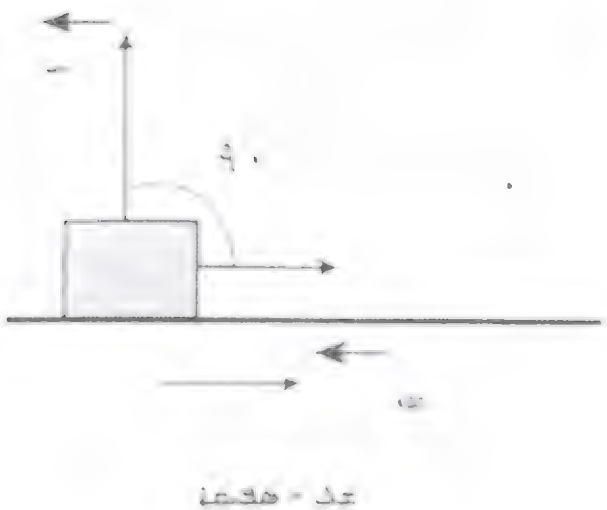
ܒܬܪ ܕܩܪܐ ܦܣܘܩܐ ܗܢܐ
ܢܕܥ ܕܐܫܟܚܬܐ ܕܥܒܳܕܐ ܦܝܙܝܩܝܐ
ܘܟܠ ܫܘܚܠܦܐ ܕܡܚܝܠܬܐ ܒܝܕ ܐܫܟܚܬܐ
ܕܥܒܳܕܐ ܒܙܒܢܐ. ܘܐܦ ܟܠ ܫܘܚܠܦܐ
ܕܬܘܩܦܐ ܘܙܢܝ̈ܗ ܘܐܫܘܕܐ ܕܥܒܳܕܐ
ܒܬܘܩܦܐ ܘܒܐܫܟܚܬܐ ܚܕ ܡܢ ܙܢܝ̈ܐ
ܕܩܢܘܢܐ ܡܢܝܢܐ ܕܝܠܗ ܩܢܘܢ
ܢܛܪܬܐ ܕܬܘܩܦܐ.

(٥ — ١) ܣܘܥܪܢܐ Work

ܦܝܫܐ ܐܡܝܪܬܐ ܡܠܬܐ ܕܣܘܥܪܢܐ ܒܡܘܚܠܐ ܠܘܝܐ ܠܒܡܣܘܬܐ ܕܟܠ ܚܕ ܗܘܐ ܕܡܘܚܐ ܐܘ ܕܓܘܡܕܡܬܐ ܕܡܢܝ ܒܗ ܒܕܒܪܐ. ܐܠܐ ܠܗ ܦܝܫܐ ܠܣܘܥܪܢܐ ܡܘܚܠܐ ܕܠܝܬܐ ܘܟܠ ܡܢ ܕܝܕܥ ܠܗܘܐ ܠܐ ܫܟܚ ܣܘܥܪܢܐ ܒܡܐ ܕܫܘܐ. ܘܡܢ ܕܒܫܝܐ ܓܠܝܬܐ ܙܡܝܪܐ ܒܐܘܪܚܐ ܐܘܦܩܐ ܠܐ ܠܝܗ ܫܟܝܪܐ ܣܘܥܪܢܐ ܥܠ ܙܡܝܪܐ ܐܠܐ ܐ. ܡܘܪܡܠܗ ܠܓܡܝܪܐ ܡܢ ܐܪܥܐ ܐܘ ܡܠܡܠܗ ܒܗ ܒܡܚܠܬܐ ܗܢܐ ܫܟܝܪܐ ܣܘܥܪܢܐ ܥܠܗ.







ܐܣܟܡܐ (٥ — ١)

ܒܫܘܫ ܡܢ ܕܐܗܐ ܠܠܟܒܬܐ ܕܣܘܥܪܢܐ ܥܠ ܚܕ ܓܘܫܡܐ ܩܠܐ ܡܢ ܗܘܫܬܐ ܕܡܘܫܚܘܬܐ ܘܥܠܠܗ ܐܗܐ ܓܘܫܡܐ ܒܐܘܪܚܐ ܕܚܝܠܐ ܡܫܟܒܢܐ ܥܠܗ ܐܘ ܒܐܘܪܚܐ ܕܫܒܩ ܡܢ ܡܫܒܚܗ ܘܒܡܘܚܠܐ ܦܝܫܐ ܦܝܫ ܠܟܝܒܐ ܣܘܥܪܢܐ ܐܝܟ ܕܡܫܟܒ ܚܝܠܐ ܥܠ ܓܘܫܡܐ ܘܡܫܝܚ ܠܬܘܩܢܬܐ ܕܡܫܟܒܢܘܬܗ ܥܠ ܐܘܪܚܐ ܕܚܝܠܐ ܕܟܒܫܗ.

ܘܣܘܥܪܢܐ (ܣܥ) ܕܡܫܟܒܠܗ ܚܝܠܐ ($\overleftarrow{\text{ܚ}}$) ܡܫܟܒ ܥܠ ܓܘܫܡܐ ܘܡܫܝܚܠܗ ܡܘܫܚܘܬܐ ($\overleftarrow{\text{ܡܫ}}$) ܗܘܐ ܦܠܛܐ ܕܓܘܦܦܐ ܡܝܬܝܐ ܠܚܝܠܐ ܘܡܘܫܚܘܬܐ

$$\text{ܣܥ} = \overleftarrow{\text{ܚ}} \cdot \overleftarrow{\text{ܡܫ}} \quad (٥ — ١)$$

$$\text{ܣܥ} = \text{ܚ}\ \text{ܡܫ}\ \text{ܓܬܒ}\ \text{ܗ} \quad (٥ — ٢)$$

ܒܕ (ܗ) ܝܠܗ ܙܘܝܬܐ ܡܒܝܢܬܐ ܒܝܢ ܚܝܠܐ ܘܡܘܫܚܘܬܐ ܐܝܟ ܒܐܣܟܡܐ (٥ — ١).

ܗܕܐ ܘܒܝܢ ܣܘܥܪܢܐ ܗܘܐ ܦܠܛܐ ܕܓܘܦܦܐ ܕܓܘܡܠܐ ܕܡܫܝܚܢܐ ܕܚܝܠܐ ܘܓܘܡܠܐ ܕܡܫܝܚܢܐ ܕܡܘܫܚܘܬܐ ܕܥܠܗ ܒܐܘܪܚܐ ܕܗܘ ܚܝܠܐ ܒܡܘܕ ܕܐܗܐ ܗܘܐ ܣܘܥܪܢܐ ܡܢ ܒܡܫܘܬܐ ܠܐ ܙܘܒܢܐ ܘܗܘܐ ܗܘܝܐ. ܚܝܠܐ ܐܘ ܡܫܟܒܗ ܗܘܐ ܒܐܘܪܚܐ ܕܡܘܫܚܘܬܐ ܐܝܟ ܕܗܘܝܐ ܗ $\nless$ ܫܬܝܬܐ. ܘܗܘܝܐ ܓܠܘܙܐ. ܗܘܝ ܗܘܐ ܚܝܠܐ ܐܘ

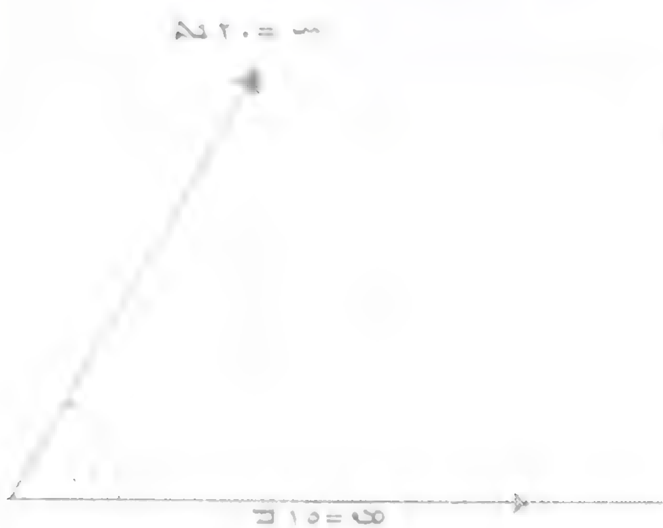
ܡܪܟܒܗ ܒܦܘܪܫܐ ܘܦܩܕܐ ܠܡܫܘܚܘܬܐ ܐܝܟ ܕܗܘܝ < ܗ ܒܗܘܬܐ ܘܗܘܐ
ܡܦܩܬܐ. ܚܝܠܐ ܗܘܐ ܒܡܘܕܝܐ ܥܠ ܡܫܘܚܘܬܐ ܡܢ ܠܥܠܡܐ ܕܗܘܝܬܐ
ܕܡܪܟܒܬܐ ܕܚܝܠܐ ܒܦܘܪܫܐ ܕܗܘ ܡܫܘܚܘܬܐ. ܐܘ: ܦܪܝܠܗ ܡܪܟܒܬܐ ܠܡܢܝܢܐ
ܘܡܦܩܬܐ ܠܥܠ ܥܘܒܕܐ ܕܥܒܕܠܗ ܚܝܠܐ ܡܪܡܝܢܐ ܗܘܐ ܣܘܡܐ ܒܗܘ ܚܝܠܐ
ܘܡܫܘܚܘܬܐ ܒܚܕ ܙܒܢܐ ܠܝܗ. ܐܠܐ ܥܘܒܕܐ ܕܥܒܕܐܠܗ ܢܦܩܬܐ ܐܪܥܬܐ
ܥܠ ܕܐܗܐ ܠܡܢܝܢܐ ܒܪܗܐ ܐܝܟܢܘܬܐ ܗܘܐ ܒܠܘܐ ܒܗܘ ܚܝܠܐ ܕܢܦܩܬܐ ܙܒܢ
ܙܒܢ ܠܚܕ ܐܠܐ ܡܫܘܚܘܬܐ ܙܒܢ ܠܟܠ ܘܐܝܟܢܘܬܐ ܕܐܪܥܬܐ ܕܠܡܢܝܢܐ ܥܠ
ܚܕ ܒܚܘܪܐ ܗܘܐ ܥܘܒܕܐ ܕܥܒܕܠܗ ܚܝܠܐ ܠܪܥܢܐ ܣܘܡܐ ܒܗܘ ܚܝܠܐ
ܘܡܫܘܚܘܬܐ ܒܚܕ ܙܒܢܐ ܠܝܗ ܐܠܐ ܥܘܒܕܐ ܕܥܒܕܠܗ ܚܝܠܐ ܕܚܪܬܐ ܥܠ
ܕܐܗܐ ܠܡܢܝܢܐ ܗܘܐ ܒܠܘܐ ܒܗܘ ܚܝܠܐ ܕܚܪܬܐ ܒܦܘܪܫܐ ܕܙܒܢܐ
ܕܡܫܘܚܘܬܐܠܗ ܐܠܐ ܒܐܝܟܢܘܬܐ ܕܡܟܬܒܐ ܕܟܬܒܐ ܥܠ ܦܘܫܐ ܘܙܠܝܬܗ
ܐܘܦܩܬܐ ܠܐ ܦܝܫ ܥܒܝܕܐ ܥܘܒܕܐ ܥܠܗ ܒܗܘ ܚܝܠܐ ܘܡܫܘܚܘܬܐ ܘܡܦܩܐ ܠܝܗ

(٥ — ٢) ܚܕܝܘܬܐ ܕܥܡܠܐ Unit of Work

ܗܟܝܠ ܚܕܝܘܬܐ ܕܥܡܠܐ ܥܠ ܚܕܝܘܬܐ ܕܚܝܠܐ ܘܡܫܘܚܘܬܐ ܘܚܝܠܐ ܦܝܫ
ܒܡܣܡܐ ܒܠܚܘܕ ܐܒܠܢܐ ܒܢܝܘܛܢ. ܘܡܫܘܚܘܬܐ ܒܡܝܛܪܐ ܘܥܡܠܐ ܦܝܫ
ܒܡܣܡܐ ܒ(ܢܝܘܛܢ. ܡܝܛܪܐ) ܘܦܫܛܐ ܡܥܒܕܗܘܬܐ ܓܘܠ (Joul) ܘܓܘܠ ܝܠܗ
(ܚܕܝܘܬܐ ܕܥܡܠܐ ܕܥܒܕܠܗ ܚܝܠܐ ܣܟܝܬܐ ܚܕܝܘܬܗ ܚܕ ܢܝܘܛܢ. ܐ.
ܡܥܒܕܠܗ ܥܠ ܠܡܢܝܢܐ ܠܡܫܘܚܬܗ ܒܦܘܪܫܗ ܚܕ ܡܝܛܪܐ) ܘܦܝܫ ܒܡܣܡܐ
ܥܡܠܐ ܒܐܪܓ (Erg) ܐܠܐ ܐ. ܝܗܘܐ ܚܝܠܐ ܒܡܣܡܐ ܒܕܐܝܢ ܘܡܫܘܚܘܬܐ
ܒܣܢܬܝܡܝܛܪܐ ܘܐܪܓ ܝܠܗ (ܚܕܝܘܬܐ ܕܥܡܠܐ ܕܥܒܕܠܗ ܚܝܠܐ ܣܟܝܬܐ
ܚܕܝܘܬܗ ܚܕ ܕܐܝܢ ܐ. ܡܥܒܕܠܗ ܥܠ ܠܡܢܝܢܐ ܠܡܫܘܚܘܬܗ ܒܦܘܪܫܗ ܚܕ
ܣܢܬܝܡܝܛܪܐ). ܘܡܢ ܕܐܗܐ ܒܢܘܚܢ ܕܐܪܓ ܒܝܕ ܙܢܕܐ ܝܠܗ ܕܪܐ ܡܢ ܓܘܠ ܒܕ
ܢܝܘܛܢ ܒܘܐ $١٠^{٥}$ ܕܐܝܢ ܘܡܝܛܪܐ ܒܘܐ $١٠^{٢}$ ܣܢܬܝܡܝܛܪܐ ܘܡܕܝܢ ܓܘܠ ܒܘܐ
$١٠^{٧}$ ܐܪܓ.

ܛܘܦܣܐ (١)

ܟܡܐ ܝܠܗ ܟܘܠܐ ܕܥܘܒܕܐ ܕܥܒܕܠܗ ܚܝܠܐ ܟܘܠܗ (٢٠ ܢܝܘܛܢ) ܠܓܪܫ ܠܩܘܛܐ ܥܠ ܐܪܥܐ ܠܦܫܛܐ ܡܫܘܚܬܐ ܟܘܠܗ (١٥ ܡܝܬܪܐ)، ܐܢ ܐܗܐ ܚܝܠܐ ܠܒܝܐ ܗܘܐ ܒܙܘܝܬܐ (٦٠°) ܡܢ ܣܛܪܐ ܕܐܪܥܐ ܟܘܡܬܐ ܒܓܘܠ ܡܢ ܒܐܪܐ.



ܨܘܪܬܐ (٥ ـ ٢)

ܫܪܝܐ

ܒܦܘܬ ܨܘܪܬܐ (٥ ـ ٢) ܠܐܗܐ ܐܝܟܢܘܬܐ

ܥܘܒܕܐ = ܚ ܡܫ ܓܝܒ ܗ

= ٢٠ × ١٥ ܓܝܒ ٦٠ = ١٥٠ ܓܘܠ

ܓܘܠ = ١٠ ^٧ ܐܪܓ

ܥܘܒܕܐ = ١٥٠ × ١٠ ^٧

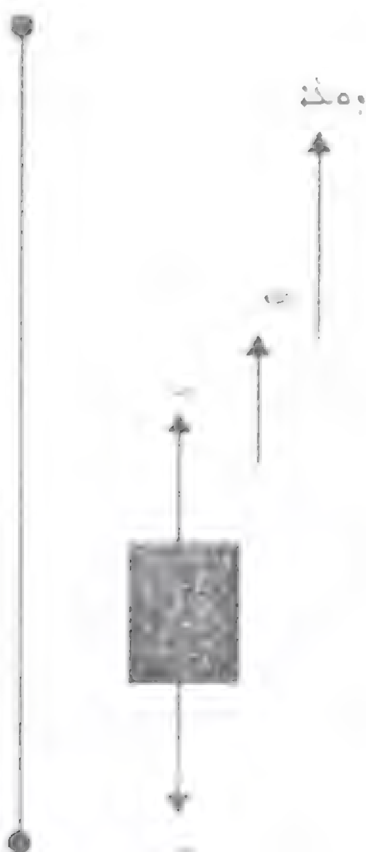
= ١٥ × ١٠ ^٨ ܐܪܓ

ܛܘܦܣܐ (٢)

ܐ ـ ܟܡܐ ܝܠܗ ܟܘܠܐ ܕܥܘܒܕܐ ܕܥܒܕܐ ܠܗ ܡܪܡܝܬܐ ܕܩܘܛܐ ܟܘܠܗ (١٠ ܟܓܡ) ܒܬܘܠܬܘܠܐ ܡܬܘܩܢܬܐ ܘܡܦܪܝܬ ܙܘܥ ܠܥܠ ܡܫܘܚܬܐ ܟܘܠܗ (٠.٥ ܡܝܬܪܐ).

ܒ ـ ܐܝܟ ܢܦܠܬܐ ܕܩܘܛܐ ܒܬܘܠܬܘܠܐ ܡܬܩܢܬܐ ܒܡܫܘܚܬܐ ܒܗܝ.

ܓ ـ ܐܝܟ ܢܦܠܬܐ ܕܩܘܛܐ ܚܕܐ ܡܢ ܪܡܘܬܐ ܒܗܝ.



ܨܘܪܬܐ (٥ ـ ٣)

ܫܪܝܐ

ܐ ـ ܐܝܟ ܡܪܡܝܬܐ ܕܩܘܛܐ ܘܡܦܪܝܬ ܙܘܥ ܠܥܠ ܒܬܘܠܬܘܠܐ ܡܬܩܢܬܐ ܚܝܠܐ ܡܪܝܡܢܐ ܝܠܗ ܥܕܠ ܡܘܫܟܐ ܒܟܘܠܐ

ܘܗܦܓܠܐ ܒܙܘܓܐ ܗܘܐ ܥܒܕ ܚܝܠܐ ܘܡܫܢܝܢܘܬܐ ܒܚܕ ܙܘܓܐ ܐܝܟ ܒܨܘܪܬܐ (٥ ـ ١٣).

ܬܒ = ܚ ܡܘ ܓܬܒ ܗ

ܘܟܕ ∢ ܗ = ܨܦܪܐ . ܓܬܒ ܗ = ١

ܬܒ = ܚ ܡܘ

ܘܟܕ ܚ = ܢ = ܡ ܓ

ܐ. ܣܬܒܠܝ ܡ ١٠ ܡ ܕܩ٢

ܚ = ١٠ × ١٠ = ١٠٠

ܬܘܒܠܐ = ١٠٠ × ٠.٥ = ٥٠ ܓܘܠ

ܨܘܪܬܐ ٥ ـ ٣ܒ

ܒ. ܒܐܝܟܢܘܬܐ ܕܡܫܢܝܬܐ ܕܓܘܫܡܐ ܘܡܫܐܝܠ ܒܡܠܘܠܘܬܐ ܡܫܝܚܬܐ ܗܘܐ ܚܝܠܐ ܙܘܒ ܠܓܒܠ ܘܡܫܢܝܘܬܐ ܙܘܒ ܠܓܘܫܡ ܗܘܐ ܥܒܕ ܝܠܝܗ ܦܘܬܐ ܘܙܘܝܬܐ ܒܝܢܬܝܗ ١٨٠ ܨܘܪܬܐ ٥ ـ ٣ܒ.

ܬܒ = ܚ ܡܘ ܓܬܒ ܗ

ܬܘܒܠܐ = ١٠٠ × ٠.٥ ܓܬܒ ١٨٠

= ٥٠ × (−١) = − ٥٠ ܓܘܠ

ܓ. ܒܐܝܟܢܘܬܐ ܕܢܦܠܬܐ ܕܓܘܫܡܐ ܚܐܬܝܬ ܚܝܠܐ ܡܫܬܒܬܐ ܚܠܘ ܝܠܗ ܡܘܡܬܗ ܘܗܘܐ ܒܙܘܓܐ ܕܡܫܢܝܘܬܐ ܗܘܐ ܥܒܕ:

ܨܘܪܬܐ ٥ ـ ٣ܓ

∢ ܗ = ܨܦܪܐ

ܫܓ = ܚ ܡܫ ܓܬܐ ܗ

= ١٠٠ × ٠.٥ × ١ = + ٥٠ ܓܘܠ

ܘܠܗ ܚܝܠܐ ܕܥܒܕܐ ܠܗ ܬܘܩܦܬܐ ܐܬܬܐ ܥܠ ܓܘܫܡܐ.

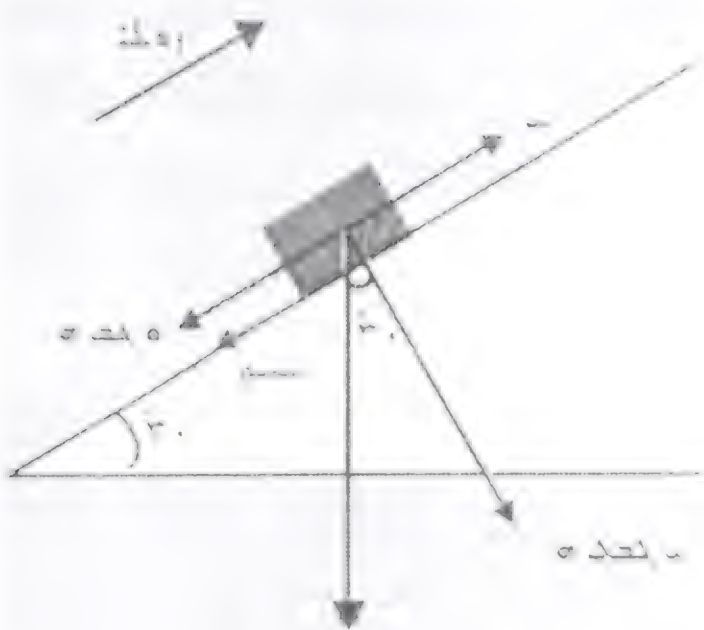
ܡܘܦܬܐ (٣)

ܩܪܒܘ ܠܪܫܐ ܓܘܫܡܐ ܕܡܬܩܠܗ ١٠ ܟܝܠܘ ܕܡܫܠܡܬܐ ܡܣܡܟܬܐ ܠܪܫܐ ܕܡܝܠܢܐ ܠܙܢܐ ܕܙܢܐ ٣٠ ܡܢ ܐܘܩܢܐ ܒܚܝܠܐ ܡܫܘܝܐ ܠܡܝܠܢܐ ܒܡܫܝܚܘܬܐ ܒܘܠܗ (٩) ܡܛܪ̈ܐ ܘܐ. ܚܝܠܐ ܕܚܟܘܟܬܐ ܒܝܢ ܓܘܫܡܐ ܘܡܝܠܢܐ (٢٠) ܢܝܘܛܢ. ܐܬܚܫ

١ ـ ܣܘܟܠܐ ܙܒܝܫܐ ܕܡܥܒܕ ܚܝܠܐ ܕܚܟܘܟܬܐ.

٢ ـ ܣܘܟܠܐ ܙܒܝܫܐ ܠܘܩܒܠܐ ܥܠ ܝܘܩܪܐ.

٣ ـ ܣܘܟܠܐ ܕܥܒܕܠܗ ܚܝܠܐ ܕܪܫܝܐ.



ܐܣܟܡܐ (٥ ـ ٤)

ܫܪܝܐ

ܚܘܝܢ ܒܐܣܟܡܐ (٥ ـ ٤) ܕܚܝܠܐ ܕܚܟܘܟܬܐ (ܚܚ) ܘܡܫܪܚܬܐ ܕܝܘܩܪܐ ܡܫܘܝܬܐ ܠܡܝܠܢܐ (ܝ ܓܒ ܗ) ܗܪܘܝܗ ܗܦܟܐ ܠܥܘܗ ܠܘܩܒܠܐ ܕܓܘܫܡܐ ܗܢܐ ܘܒܗ ܒܗܦܟܐ ܕܙܘܥܐ ܕܡܫܝܚܘܬܐ.

ܝܘܩܪܐ ܕܓܘܫܡܐ = ܓ ܡ = ١٠ × ١٠ = ١٠٠ ܢܝܘܛܢ

ܡܫܪܚܬܐ ܕܝܘܩܪܐ ܡܫܘܝܬܐ ܠܡܝܠܢܐ = ܝ ܓܒ ܗ = ١٠٠ ܓܒ ٣٠ = ٥٠ ܢܝܘܛܢ

١ ـ ܫܓ = ܚ ܡܫ ܓܬܐ ܗ

ܘܚܝܠܐ ܡܬܠܬܠܐ ܕܡܥܒܕ ܚܟܘܟܬܐ ܗܘ ܒܗܦܟܐ ܕܡܫܝܚܘܬܐ

∢ ܗ = ܡܦܩܐ

ܣܘܟܠܐ ܡܫܘܚܠܐ ܕܡܥܒܕ ܚܟܘܟܬܐ = ٢٠ × ٩ = ١٨٠ ܓܘܠ

٢ . ܐܦ ܚܝܠܐ ܡܬܠܝܐ ܕܢܦܘܩ ܡܢܒܥܐ ܕܚܘܡܐ ܡܬܒܥܝܢܐ ܠܓܠܝܕܐ ܗܘܐ ܒܙܘܥܐ ܕܡܘܫܚܬܐ.

⊁ ܗ = ܡܦܝܩܐ

ܚ = ٥٠ ܓܪܡ.

ܟܒ = ܚ ܡܘ = ٥٠ × ٩ = ٤٥٠ ܟܠܘܪ

٣ . ܚܝܠܐ ܓܡܝܪܐ = ܚܝܠܐ ܕܫܚܢܘܬܐ + ܡܫܘܚܬܐ ܕܚܘܡܐ ܡܬܒܥܝܢܐ ܠܓܠܝܕܐ ܟܠܗ

ܚ = ٢٠ + ٥٠ = ٧٠ ܓܪܡ.

ܟܒ = ܚ ܡܘ = ٧٠ × ٩ = ٦٣٠ ܟܠܘܪ

ܫܪܐ ܗܘܝܘ ܡܢ ܕܐܗܐ ܕܥܘܟܠܐ ܦܠܝܓܐ ܡܢ ܚܝܠܐ ܓܡܝܪܐ = ܟܘܢܫܐ ܕܥܘܟܠܐ ܡܘܣܦܐ ܥܠ ܚܝܠܐ ܕܫܚܢܘܬܐ ܘܥܠ ܡܫܘܚܬܐ ܕܚܘܡܐ ܡܬܒܥܝܢܐ ܠܓܠܝܕܐ.

ܟܒ = ١٨٠ + ٤٥٠ = ٦٣٠ ܟܠܘܪ

ܫܘ̈ܐܠܐ

ܫ١ : ܡܢ̈ܘ ܦܪ̈ܝܫܘ ܠܠܫܢܐ ܕܫܘܬܦܐ ܒܡܘܬܒ̈ܐ ܦܝܢܢܫܝ̈ܐ؟

ܫ٢ : ܐܢ̈ܐ ܟܬܒ ܟܬܘܒܐ ܕܡܬܩܪܐ ܕܠܡܢܐ ܫܘܬܦܐ ܥܠ ܕܐܗܐ ܕܠܡܢܐ؟ ܘܠܡܢܐ؟

ܫ٣ : ܠܡܢܐ ܗܘܐ ܫܘܬܦܐ ܚܫܝܒܐ ܠܡܬܝܒܘܬܐ ܕܫܡܐ ܡܢ ܦܪ̈ܝܫܘ ܚܝܠܐ ܡܬܝܚܐ ܒܝܕ ܫܘܪܝܐ ܡܢ ܫܘܬܦܐ ܕܫܬܦܘܗܝ ܐܢܐ ܚܝܠܐ ܒܗܘ ܠܡܬܝܒܘܬܐ ܕܠܦܐ ܚܠܘܦܝ̈ܐ؟

ܫ٤ : ܦܬܓܡ ܗܝܕܐ ܘܕܬܐ ܡܢ ܗܝܕܐ ܙܘܥܪ̈ܐ ܚܕ ܐܢ̈ܫܐ ܒܒܢܘܢܝ ܚܘܕ̈ܢܐ ܡܬܚܒܪܐ ܡܬܦܪܫܝܢ ܠܗ ܡܬܦܪܫ. ܒܡܘܬܒܐ ܐܢ̈ܫܐ. ܟܡܐ ܢܛܠܘ ܫܘܬܦܐ ܕܫܬܦܘܗܝ ܢܦܘܩܐ ܐܢܫܐ ܥܠܝܗ؟ ܘܠܡܢܐ؟

ܫ٥ : ܦܫܘܩ ܒܝܢ ܫܘܬܦ̈ܐ ܘܡܘܬܒ̈ܐ.

ܫ٦ : ܢܦܩ ܕܫܘܬܦܐ ܚܫܝܒܐ ܠܡܬܝܒܘܬܐ ܕܠܘܩܒܠ ܠܡܬܘܬܐ ܡܕܝܢܬܐ ܒܡܦܠܬܐ ܕܐܢܫܝ̈ܐ ܠܟܠ ܒܢܝ̈ܐ ܗܕܐ ܠܗ ܒܡܢܐ ܕܐܝܠܝܢ ܠܢܫܐ ܕܐܗܐ ܢܦܫܐ. ܠܟܠ ܚܕܐ.

ܡܬܚܙܝܢܘܬܐ : ܚܫܘܒ ܕܫܘܬܦܐ ܒܡܘܬܒ̈ܐ ܐܢ̈ܫܐ ܠܗ ܫܢܬܐ ܕܫܘܐܠܐ ܕܐܝܬ ١٠ ܡ ܕܦ٢.

ܫ٧ : ܠܬܠܬܐ ܕܝܢܘܬܐ ܡܬܚܒܪܝܢ ܥܠ ܐܢܫܐ ܒܡܬܠܘ (٢٠ ܡܢܝܢ) ܒܡܠܘܠܘܬܐ ܗܝܕܐ ܐܝܟ ܚܠܦ ܐܦܣܝܐ ܒܡܠܘ (٥٠) ܢܘܦ. ܟܡܐ ܢܛܠ ܒܡܠܐ ܕܫܘܬܦܐ ܐܢܫܐ؟

ܐ. ܠܬܠܬܐ ܕܝܢܘܬܐ ܡܬܚܒܪܬܐ (٥) ܡܢܝܢ ܥܠ ܐܢܫܐ.

ܒ. ܫܘܬܦܐ ܕܝܗܒܘ ܚܕܐ ܥܠ ܙܒܢܐ.

ܓ. ܠܡܬܝܒܘܬܐ ܕܝܢܘܬܐ ܘܡܬܢܝܚܐ ܡܬܚܒܪܬܐ ܒܡܠܘ (٥) ܡܢܝܢ.

ܦ : ٢٥٠ ܓܘܠ - ٢٥٠ ܓܘܠ . ١٠٠٠ ܓܘܠ

ܫ٨ : ܗܠܝܢ ܡܫܬܐ ܢܘܩܝܢ (٦) ܡܢܝܢ ܘܒܡܬܠܘ (٨) ܡܢܝܢ ܘܡܬܠܘ. ܕܢܘܡܘ ܟܬܒ ܗܢܐ ܡܢܝܢܐ ܡܢ ܐܢܘ ܢܦܫܐ ܥܠ ܐܢܫܐ ܟܡܐ ܢܛܠ ܒܡܠܐ ܕܫܘܬܦܐ ܐܢܫܐ ܠܡܡܬܡܘ ܒܝܘܡܬܐ ܟܡܘܢܬܐ ܥܠ ܐܢܘ؟

ܦ : ١٦٠ ܓܘܠ

ܫ٩ : ܦܢܐ ܢܠܘ ܚܠܝܒܬܐ ܠܬܒܬܐ ܕܠܘܩܒܠ ܒܡܬܠܘ ٣٠ ܡܢܝܢ ܥܠ ܐܢܫܐ ܘܦܣܩܬܐ ܒܡܠܘܠܘܬܐ ܗܝܕܐ ܘܐ. ܟܬܘܒܐ ܕܫܬܝܬܐ ܒܝܢ ܠܘܩܒܠ ܘܐܢܫܐ

(٦٠٠) ܟܡܐ ܝܠܗ ܟܘܦܠܐ ܕܟܘܦܠܐ ܚܫܒܢܐ ܠܓܪܓܡܐ ܕܐܗܐ ܛܘܦܣܐ ܡܙܝܢܘܬܐ
ܟܘܦܠܗ ٥،٠٠ ܡܝܠܝܐ؟ ܦ : ٩٠ ܛܘܢ

ܓ١٠ : ܛܘܦܣܐ ܟܘܦܠܗ ٤٦ ܟܝܠܘ ܡܘܠܝܐ ܥܠ ܐܪܒܥܐ ܐܘܦܣܝܬܐ ܡܘܟܒܪܠܗ ܥܠܗ ܚܠܠܐ ܟܘܠܝܬܐ ٣٧ ܡܢ ܐܘܦܣܐ ܘܐ. ܟܡܐ ܕܚܡܝܬܐ ܟܝܢ ܛܘܦܣܐ ܘܓܠܫܐ ܕܪܪܐ ٢،٠٠ ܟܡܐ ܝܠܗ ܟܘܦܠܐ :

ܐ ـ ܚܠܐ ܡܟܒܪܢܐ ܥܠ ܛܘܦܣܐ ܠܗ ܠܓܪܓܡܘ ܟܘܠܘܠܬܐ ܡܙܝܢܬܐ .
ܦ : ١٠٠ ܟܘܦܝ

ܒ ـ ܟܘܦܠܐ ܚܫܒܢܐ ܠܓܪܓܡܐ ܕܛܘܦܣܐ ܡܙܝܢܘܬܐ ١٢ ܡܝܠܝܐ .
ܦ : ٩٦٠ ܛܘܢ

ܓ١١ : ܛܘܦܣܐ ܟܘܦܠܗ (٤٠ ܟܝܠܘ) ܡܘܠܝܐ ܥܠ ܓܠܫܐ ܓܢܒܝܐ ܛܝܢܐ ٣٠ ܡܢ ܐܘܦܣܐ ܟܡܐ ܝܠܗ ܟܘܦܠܐ ܕܟܘܦܠܐ ܚܫܒܢܐ ܠܓܪܓܡܘ ܡܙܝܢܘܬܐ ܟܘܦܠܗ (١٠) ܡܝܠܝܐ ܠܟܠ ܕܓܠܫܐ ܒܡܘܕܥܢܐ ܡܛܟܣܐ ܟܘܦܠܗ ٢ ܡܝܠܝܐ ܕܦ ٢ ؟
ܦ : ٢٨٠٠ ܛܘܢ

ܓ١٢ : ܛܘܦܣܐ ܟܘܦܠܗ ٢٠٠٠ ܟܝܠܘ ܕܚܕ ܥܠ ܓܠܫܐ ܐܘܦܣܝܬܐ ܓܢܒܝܬܐ ܕܙܘܦܠܘܬܐ (٤٠ ܡܢ ܕܦ) ܡܘܟܒܪܠܗ ܥܠܗ ܚܠܠܐ ܐܘܦܣܝܬܐ ܘܦܫܠܗ ܙܘܦܠܘܬܗ ٦٠ ܡܢ ܕܦ ܒܙܘܦܢܐ ܟܢܫܘ ܟܠܕ (٥ ܕܦ) ܡܢ ܓܘܕܢܐ ܕܡܟܒܪܢܘܬܐ ܕܚܠܐ.
ܟܡܐ ܝܠܗ ܟܘܦܠܐ ܕܟܘܦܠܐ ܕܡܟܒܪܠܗ ܐܗܐ ܚܠܐ ܒܐܗܐ ܡܕܫܐ ؟
ܦ : ٢ ، ١٠ ٦ ܐܪܓ

(٥ — ٣) ܡܨܝܢܬܐ Power

ܦܬܐ ܡܫܘܚܬܐ ܡܨܝܢܬܐ ܕܐܝܬܘܗ̇ ܡܨܚܐ ܘܒܢܐ ܠܥܒܕܬܐ ܕܥܘܒܕܐ ܗܢܐ ܘܕܝܢ ܐܝܬܘܗ̇ ܥܘܒܕܐ ܥܒܝܕܐ ܒܫܢܝܘܬܐ ܕܙܒܢܐ ܘܡܨܝܢܬܐ ܐܝܬܘܗ̇ ܥܒܕܬܐ ܕܐܝܬ ܐܝܟ ܡܫܘܚܬܐ ܒܚܝܠܐ ܡܢܝܘܬܢܝܬܐ ܕܐܬܪܐ :

$$ܡܨܝܢܬܐ = \frac{ܥܘܒܕܐ}{ܙܒܢܐ} = \frac{ܚ\ ܡܫ\ ܠܥܒܠ\ ܗ}{ܙ}$$

ܐܘ. ܝܗܘܬܐ ∢ ܗ = ܡܫܝܢܐ

$$ܡܨ = \frac{ܚ\ ܡܫ}{ܙ} \quad \ldots\ldots (٥ — ٣)$$

ܘܒܪ $\frac{ܡܫ}{ܙ}$ = ܡܨ ܬ ܐܝܟ ܕܡܬܩܪܝܐ ܡܠܘܠܘܬܐ ܒܪܘܕܬܐ ܡܫܘܚܬܐ

$$ܡܨ = ܚ\ ܡܨ\ ܬ\ ܠܥܒܠ\ ܗ \quad \ldots\ldots (٥ — ٤)$$

ܐܘ. ܝܗܘܬ ∤ ܗ = ܡܫܝܢܐ

$$ܡܨ = ܚ\ ܡܨ\ ܬ \qquad (٥ — ٥)$$

ܡܨܝܢܬܐ ܝܠܗ ܡܢ ܚܫܘܒܬܐ ܡܫܢܝܢܐ ܗܢܐ ܘܕܝܢ ܠܐ ܐܠܗ ܡܨܝܢܝܬܐ ܘܦܬܐ ܒܝܠܬܐ ܒܫܢܝܘܬܐ ܕܥܘܒܕܐ ܦܠܝܓܐ ܥܠ ܫܢܝܘܬܐ ܕܙܒܢܐ ܐܝܟ (ܓܘܠ ܕܦ) ܘܦܬܐ ܡܕܝܬܐ ܗܝ ܐܝܬܐ ܫܢܝܘܬܐ ܒܘܬ ܘܥܠ (١٠٠٠ ܘܬ) ܬܘܒ ܚܕ ܒܝܠܘܬ ܘܐܝܟ ܬܘܒ ܫܢܝܘܬܐ ܦܬܐ ܡܕܝܬܐ ܒܚܘܫܒܐ ܘܬܘܒܐ ٧٤٦ ܘܬ ܐܘ

ܡܘܕܒܐ $\frac{}{ܙ}$ ܒܝܠܘܬ.

ܫܘܐ̈ܠܐ

ܫ١ : ܡܢ ܝܠܗ ܣܘܟܠܐ ܕܡܠܬܐ ܡܫܘܚܬܐ ܓܘ ܦܝܙܝܟ؟ ܘܡܢ ܝܠܗ ܚܕܝܘܬܗ؟

ܫ٢ : ܟܡܐ ܝܠܗ ܥܒܕܐ ܕܓܘܠܐ ܒܒܝܬܐ ܕܥܒܕܠܗ ܡܫܘܪ ܡܫܘܚܬܗ ٢٠٠ ܟܝܠܘܘܛ؟

ܫ٣ : ܬܠܡܝܕܐ ܕܡܕܪ̈ܫܬܐ ܒܗܕܟܐ ٨١ ܚܒܫ ܠܕܘܟܬܐ ܕܡܫܘܚܬܗ (١٠٠ ܡܝܬܪܐ)، ܟܡܐ ܝܠܗ ܒܘܒܠܐ ܕܥܒܕܠܗ ܬܠܡܝܕܐ ܕܡܘܚܒ ܢܘܦܘܬܐ ܕܚܕܬܐ؟ ܘܐܢܐ ܚܠܐ ܐܘܐ ܡܫܘܚܬܐ ܕܒܘܒܠܐ ܟܠ ܡܢܘܠܐ ܕܚܕ ܒܗ ܬܠܡܝܕܐ؟ ܐ. ܘܒܝܢܐ ܕܬܠܡܝܕܐ ܗܘܐ (٩٠) ܡܝܠܝܢ ܟܡܐ ܝܠܗ ܡܫܘܚܬܐ ܕܡܫܘܚܬܐ ܕܐܘܐ ܬܠܡܝܕܐ ܒܗܘ؟
ܦ : ١٥ ܘܛ

ܫ٤ : ܐܠܦܐ ܡܫܘܚܬܐ ܕܡܫܚܠܦܢܐ ٣٠٠٠٠ ܟܝܠܘܘܛ ܘܦܠܚܠܗ ܦܠܚܬܐ ٢٧ ܝܘܡ ܒܫܒܬܐ ܟܡܐ ܝܠܗ ܒܘܒܠܐ ܕܚܘܝܠܗ ܕܡܫܠܡܠܗ ܐܠܦܐ ܐܝܟ ܕܐܝܬ ܒܗ ܦܠܚܬܐ؟
ܦ : ٤ × ١٠[٦] ܓܘܠ

ܫ٥ : ܟܡܐ ܝܠܗ ܡܫܘܚܬܐ ܕܒܠܥܬܐ ܡܢ ܢܗܪܐ ܕܡܝܐ ܕܢܦܠܐ ܡܢ ܪܘܡܐ (٣٠ ܡܝܬܪܐ) ܒܕܩܝܩܬܐ ٥٠٠ ܛܢܐ ܡܝܬܪܐ ܡܢ ܡܝܐ ܒܕܩܝܩܬܐ؟
ܦ : ٢٥٠٠ ܟܝܠܘܘܛ.

ܫ٦ : ܦܘܡܦܐ ܡܫܘܚܬܗ ٢٥ ܟܝܠܘܘܛ ܡܕܠܐ ܡܝܐ ܡܢ ܥܘܡܩܐ (٥ ܡܝܬܪܐ) ܟܡܐ ܝܠܗ ܟܡܝܘܬܐ ܡܢ ܡܝܐ ܕܡܕܠܝܠܗ ܦܘܡܦܐ ܒܚܕ ܕܩܝܩܐ ܒܫܥܬܐ ܕܠܐ ܚܘܫܒܢܐ ܕܒܘܒܠܐ ܚܒܝܫܐ ܒܗ ܦܘܡܦܐ؟
ܦ : ٥٠٠ ܟܓܡ

ܫ٧ : ܟܡܐ ܝܠܗ ܡܫܘܚܬܐ ܕܡܫܚܠܦܢܐ ܒܟܝܠܘܘܛ ܠܛܢܐ ܡܫܚܠܦܐ ܒܕܘܪܐ ٣٠ ܝܘܡ ܒܫܒܬܐ ܠܟܠ ܕܪܓܐ ܟܡܐ ܚܕ ܡܝܬܪܐ ܠܟܠ (١٠٠ ܡ)، ܡܢ ܗܘܕܝܐ ܟܘܠܐ ܕܡܫܚܠܦܢܐ ܗܘܐ ٢٠٠ ܛܢܐ ܡܝܬܪܐ ܡܟܘܪܐ ܕܫܟܠܐ ٥٠ ܕܩܝ. ܠܟܠ ܛܢܐ؟
ܦ : ٢٥٠ ܟܝܠܘܘܛ

(٥ — ٤) ܬܘܩܦܐ Energy

ܐ. ܠܘܚܡܐ ܗܘܐ ܡܗܝܢܐ ܥܠ ܟܡܝܘܬܐ ܕܩܘܠܠܐ ܐܗܐ ܡܘܬܠܗ ܠܗ ܕܠܘܚܡܐ ܐܝܬܠܗ ܬܘܩܦܐ. ܘܟܠ ܡܢ ܓܒܐ ܕܡܫܚܠܦܐ ܕܠܒܫܐ ܘܨܘܪܬܐ ܦܠܚܬܐ ܐܝܬܠܗ ܬܘܩܦܐ ܘܡܥܒܕܢܘܬܐ ܕܓܒܐ ܕܡܫܚܠܦ ܠܡܕܝܢ ܟܕ ܟܢܫܐ ܐܘ ܟܝܢܐ ܕܡܠܘܠܬܐ ܕܠܘܠܐ ܟܟܕ ܩܘܠܠܐ ܡܬܢܚܬܐ. ܘܐܢܬ ܬܡܠ ܕܬܐ ܡܢ ܦܘܩܕܐ ܐܫܝܢܐ ܥܠ ܕܐܗܐ ܡܐ ܦܘܩܕܐ ܕܦܝܐ ܕܟܠܬܐ ܡܫܚܠܦܐ ܠܦܘܠܚܢܐ ܐܝܬܠܗ ܬܘܩܦܐ ܟܟܕܠܗ ܡܢܝܢܐ ܡܢ ܡܦܠܚܬܐ ܕܟܠܬܐ. ܘܕܡܘܡܐ ܢܫܬܐ ܥܠ ܙܙܐ ܐܝܬܠܗ ܬܘܩܦܐ ܟܕ ܟܟܕ ܩܘܠܠܐ ܠܗ ܡܫܚܬܗ ܠܙܪܐ ܠܡܟܬܒܬܗ ܠܗ ܡܫܟܚܐ ܕܡܩܪܐ ܡܬܢܚܘܬܐ ܡܬܢܚܬܐ. ܘܡܕܒܪܐ (ܐܝܟ ܟܕܘܢ) ܐܝܬܠܗ ܬܘܩܦܐ ܟܟܕܠܗ ܡܢܝܢܐ ܡܢ ܡܦܠܚܬܐ ܕܡܫܚܠܦܬܐ ܕܕܒܬܐ ܘܬܘܩܦܐ ܡܕܝܢ (ܠܗ ܡܢܝܢܘܬܐ ܥܠ ܟܡܝܘܬܐ ܕܩܘܠܠܐ).

ܟܠܐ ܩܘܠܠܐ ܕܟܟܕܠܗ ܠܘܚܡܐ ܥܠ ܟܘܠܝܐ ܕܡܝܐ ܙܪܦܠܗ ܐܗܐ ܠܘܚܡܐ ܡܢ ܬܘܩܦܐ ܘܠܘܟܪܐ ܕܦܟܬܐ ܟܡܠܘܠܘܬܐ ܐܘܦܡܬܐ ܠܟܘܪܬܐ ܥܠ ܐܘܪܚܐ ܟܘܢܐ ܡܢܝܐ ܕܡܫܚܠܦܐ ܡܬܢܚܘܬܐ ܟܕ ܪܬܐ ܡܢ ܡܬܢܚܘܬܐ ܕܡܫܚܠܠܗ ܐܗܐ ܠܘܟܪܐ ܐ. ܦܟܝܠܗ ܕܦܟܬܐ ܟܡܠܘܠܘܬܐ ܟܕ ܟܝܘܪܬܐ ܥܠ ܐܘܪܚܐ ܟܢܬܗ ܘܐܗܐ ܟܠܠܬܐ ܕܝܒܪܐ ܕܬܘܩܦܗ ܟܐܢܒܝܘܬܐ ܡܕܡܝܬܐ. ܘܐܦ ܠܘܚܡܐ ܡܬܡܛܝܐ ܥܠ ܪܡܘܬܐ (١٠) ܡܝܬܪܐ ܡܢ ܦܘܩܕܐ ܐܝܟ ܐܪܥܐ ܡܢ ܕܟܟܕ ܩܘܠܠܐ ܠܗ ܢܦܠܬܗ ܥܠ ܐܪܥܐ ܟܕ ܪܬܐ ܡܢ ܐ. ܗܘܐ ܗܘܐ ܥܠ ܪܡܘܬܐ (٤) ܡܝܬܪܐ. ܘܐܗܐ ܡܘܬܠܗ ܠܗ ܕܩܘܠܠܐ ܟܡܒܪܐ ܟܠܐ ܥܠ ܟܡܝܘܬܐ ܕܬܘܩܦܐ ܕܙܪܦܠܗ ܠܘܚܡܐ. ܘܟܡܬ ܠܘܚܡܐ ܠܐ ܝܒܠ ܬܘܩܦܗ ܐ. ܦܟܝܠܗ ܟܡܒܪܐ ܩܘܠܠܐ ܥܠܗ. ܐܦ ܠܐ ܟܝܪ ܬܘܩܦܗ ܐ. ܠܐ ܟܟܕܠܗ ܩܘܠܠܐ. ܘܓܒܐ ܕܡܫܚܠܦܐ ܡܐ ܦܘܩܕܐ ܘܠܐ ܕܦܟܝ ܟܡܒܪܐ ܥܠܗ ܩܘܠܠܐ ܡܐ ܕܟܕܐ ܠܗܘ ܬܘܩܦܐ. ܘܠܘܠܐ ܘܠܐ ܕܦܟܝ ܟܡܒܪܐ ܥܠܗ ܩܘܠܠܐ ܡܢ ܦܡܟܬܐ ܕܟܕܘܒܐ ܡܐ ܕܦܠܚ ܘܟܕܐ ܠܗܘ ܬܘܩܦܐ. ܘܡܢ ܗܕܡܗ ܦܘܩܕܐ ܟܡܒܪܐ ܟܫܘܫ ܕܐ. ܠܐ ܗܘܐ ܩܘܠܠܐ ܥܠܗ ܠܐ ܟܕܐ ܗܘܐ ܠܗܘ ܬܘܩܦܐ. ܦܟ ܟܡܬܢܐ ܬܘܩܦܐ ܟܫܒܝܘܬܐ ܕܩܘܠܠܐ ܟܢܗܘ ܗܢܐ ܘܡܢ ܠܘܠ ܘܐܪܥ ܘܟܕܢܐ ܕܦܟ ܟܡܬܢܐ ܟܡܠܘܠܘܬ ܟܟܕܬܐ ܘܠܗ ܫܒܝܘܬܐ ܕܦܟ ܟܡܬܢܐ ܟܗ ܬܘܩܦܐ ܒܗܕܢܢܐ ܐܘ ܐܠܟܛܪܘܢ ܦܘܠܛ ܕܫܘܐ $1,6 \times 10^{-19}$ ܓܘܠ ܘܦܬܢܐ ܡܦܠܚܬܐ ܐܗܐ ܫܒܝܘܬܐ ܕܟܢܐ ܐܝܟ ܫܒܝܘܬܐ ܕܬܘܩܦܐ ܠܗ ܦܘܫܐ ܫܒܬܐ ܢܗܝܪܬܐ.

(٥ — ٥) ܙܢܝ̈ܐ ܕܬܘܩܦܐ

ܠܬܘܩܦܐ ܝܠܗ̇ ܟܡܐ ܙܘܢܝ̈ܐ ܦܪ̈ܝܫܐ ܘܡܫܚܠܦܐ ܝܠܗ̇ ܒܫܠܡܘܬܗ ܠܐܚܪܬܐ ܘܗܢ ܙܢܝ̈ܗ̇ :

١ — ܬܘܩܦܐ ܡܟܢܝܟܝܐ Mechanical Energy ܘܗܘܐ ܒܬܪܝ ܙܢܝ̈ܐ:

ا — ܬܘܩܦܐ ܟܡܝܢܬܐ Potential Energy ܒܙܢܝܘ: ܬܘܩܦܐ ܕܢܓܕܬܐ . ܘܬܘܩܦܐ ܕܡܬܝܚܘܬܐ . ܘܬܘܩܦܐ ܦܠܝܛܐ ܡܢ ܪܘܟܒܐ ܟܝܡܝܝܐ ܕܗܘܠܐ.

ب ـ ܬܘܩܦܐ ܙܘܥܢܝܐ Kinetic Energy .

٢ ـ ܬܘܩܦܐ ܕܫܚܝܢܘܬܐ.

٣ — ܬܘܩܦܐ ܕܒܪ̈ܩܐ .

٤ ـ ܬܘܩܦܐ ܩܠܐ .

٥ — ܬܘܩܦܐ ܡܓܢܝܛܝܣܝܐ .

٦ ـ ܬܘܩܦܐ ܢܘܗܪܐ .

٧ ـ ܬܘܩܦܐ ܢܘܬܝܐ .

٨ ـ ܬܘܩܦܐ ܟܝܡܝܝܐ.

(٥ — ٦) ܬܘܩܦܐ ܟܡܝܢܬܐ Potential Enerfy

ܬܘܩܦܐ ܟܡܝܢܬܐ ܝܠܗ̇ ܟܡܝܘܬܐ ܕܬܘܩܦܐ ܙܘܕܬܐ ܠܗ ܠܓܘܫܡܐ ܕܡܫܬܚܠܦܐ ܝܠܗ̇ ܕܟܠ ܚܕ ܡܢ ܕܘܟܬܐ ܐܝܟ ܕܦܬܐ ܡܠܝܬܐ ܐܘ. ܘܗܘܐ ܒܬܪܝ ܙܢܝ̈ܐ:

ܐ ـ ܬܘܩܦܐ ܟܡܝܢܬܐ ܕܢܓܕܬܐ :

ܠܓܘܫܡܐ ܕܝܡܐ ܡܢ ܥܠܡܐ ܐܪܥܐ ܡܫܬܢܐ ܝܠܗ̇ ܐܝܟ ܡܢܐ ܕܢܦܠܬܐ ܡܢ ܠܪܘܡܐ ܡܢ ܬܘܩܦܐ ܙܘܕܬܐ ܒܬܘܠܛܐ ܕܐܢܓܕܘܬܐ ܕܪܥܝܬܐ. ܘܠܗ ܢܩܠܬܐ ܕܐܗ̇ ܠܓܘܫܡܐ ܠܬܘܡܐ ܥܠܝܐ ܡܢ ܕܟܠ ܚܕ ܕܘܟܬܐ ܒܠܠܬܐ ܕܡܘܢܕܗ ܒܘܕ ܕܐܗ̇ ܦܝ ܡܢܐ ܬܘܩܦܐ ܒܬܘܩܦܐ ܟܡܝܢܬܐ ܕܢܓܕܬܐ ܘܒܗܝ ܬܘܩܦܐ ܦܝ ܒܓܘܫܡܐ ܒܬܘܟܠܐ ܕܡܬܠܒܠܗ ܐܘ ܝܠܕܠܗ ܡܢܗ ܒܘܕ ܕܐܗ̇ ܦܝ ܒܓܘܫܡܐ ܬܘܩܦܐ ܟܡܝܢܬܐ ܕܢܓܕܬܐ ܠܩܘܕ ܬܘܡܐ ܐܘܩܡܐ ܡܬܡܚܐ ܒܦܠܛܐ ܕܬܘܩܦܐ ܕܡܘܡܕܐ ܕ ܠܓܘܫܡܐ ܘܕܡܘܬܐ ܘܫܚܠܦܬܐ ܡܢ ܕܐܗ̇ ܬܘܡܐ ܡܬܡܚܐ.

ܬܟ = ܡ ܓ .... (٥ — ٦) ܟܕ ܓ ܕܡܘܬܐ ܘܫܚܠܦܬܐ

ܘܐ ܬܟ = ܡ ܛ ܓ .... (٥ — ٧)

ܗܘܦܩܐ ܡܫܝܢܐ ܕܦܩܝ ܫܘܡܢܝܐ ܒܚܕ ܕܩܝܩܐ ܗܘܦܠܬܐ ܗܟܠ ܥܠ ܡܘܪܐ ܕܦܩܝ ܫܝܢܐ ܐܡܘܬܘ ܡܦܩܢܐ ܘܠܐ ܗܟܠ ܥܠ ܐܚܝܢܐ ܕܡܢܘܬܐ ܕܐܚܝ ܒܗ ܡܡܬܚܐ ܕܡܬܘܡܬܐ ܕܢܘܡܝܐ ܒܗܝ ܗܟܠ ܥܠ ܐܡܘܬܐ ܘܡܦܩܬܐ.

ܡܘܦܬܐ (١)

ܟܡܐ ܢܠܘ ܒܘܥܠ ܕܗܘܦܩܐ ܡܫܝܢܐ ܕܐܫܬܠܘ ܠܡܫܡܫ ܫܪܓܐ (٨) ܘܐܛ. ܥܠ ܐܡܘܬܐ (١٢) ܫܥܬܐ ܡܢ ܝܘܡܬܐ ܕܝܪܚܐ. ܘܟܡܐ ܢܠܘ ܗܘܦܩܐ ܕܡܬܦܠܚܘ ܐܢܫ ܕܦܩܝ ܥܠ ܒܡܥܒܕܐ (٩) ܫܥܬܐ ܡܢ ܝܘܡܬܐ ܕܝܪܚܐ.

ܫܪܝܐ

ܗܦ = ܚ ܪ = ٨ × ١٢ = ٩٦ ܓܘܠ ܗܘܦܩܐ ܕܐܫܬܠܘ ܒܝܘܡܬܐ ܚܕ ܠܚܕ

ܗܦ = ܚ ܪ = ٨ × ٩ = ٧٢ ܓܘܠ ܗܘܦܩܐ ܕܐܫܬܠܘ ܠܡܫܡܫ ܘܗܘ ܥܠ ܒܡܥܒܕܐ (٩) ܫܥܬܐ ܡܢ ܝܘܡܬܐ ܕܝܪܚܐ.

٩٦ − ٧٢ = ٢٤ ܓܘܠ ܗܘܦܩܐ ܦܠܝܛܐ.

ܡܘܦܬܐ (٢)

ܢܦܠܠܘ ܟܐܦܐ ܒܡܬܠܘ ٢ ܟܓܡ ܡܢ ܐܪܘܡܬܐ ١٥ ܡܝܬܪܐ ܥܠ ܐܪܥܐ ܐܡܠܬܐ ܘܦܡܬܠܘ ܠܗܘ ܠܡܘܡܫܐ ܒܡܢܝܘ ١٠ ܗܡ ܟܡܐ ܢܠܘ ܡܦܩܬܐ ܕܚܘܪܢܐ ܕܐܡܠܬܐ ܕܡܬܦܠܝܛܘ ܠܐܘܐ ܟܐܦܐ؟

(ܚܝܠ ܬܡܢܘܬܐ ܗ = ١٠ ܡ/ ܪܦ٢)

ܫܪܝܐ

ܡܫܘܚܬܐ ܕܢܦܠܠܘ ܟܐܦܐ ܒܟܐܦܐ ܕܦܬܦܬܘ ܒܐܪܥܐ = ١٥ ܡܝܬܪܐ

ܗܘܦܩܐ ܡܫܝܢܐ ܕܟܐܦܐ ܓ ܗ ܪ = ٢ × ١٠ × ١٥ = ٣٠٠ ܓܘܠ

ܘܡܫܡܫܐ ܕܚܘܪܢܐ ܕܦܘܫܐ ܗܘܐ ܗܘܦܩܐ ܡܫܝܢܐ ܕܟܐܦܐ ܫܘܐ ܠܡܘܦܠܐ ܠܚܝܕܐ ܥܠ ܚܘܪܢܐ ܕܐܡܠܬܐ.

٣٠٠ = ܣ × ٠,١

ܣ = ٣٠٠٠ ܘܐܛ.

ܕ - ܬܘܩܦܐ ܟܡܝܢܐ ܕܓܡܝܫܘܬܐ Elastic Potential Energy

ܓܘ ܓܪܫܬܐ ܐܘ ܚܠܨܬܐ ܕܦܪܦܐ ܚܠܙܘܢܐ ܡܫܘܬܬܐ ܡܢ ܚܕ ܣܘܦܗ. ܚܝܠܐ ܡܬܚܙܐ ܡܘܚܬܘܬܐ ܘܚܫܘܒܬܐ ܕܠܐ ܡܘܪܘܒܐ ܐܘ ܕܪܦܝܐ ܟܡܟܒܟܒ ܚܝܠܐ ܗܦܟܐ ܦܝܫ ܬܐܡܝܢ ܥܡ ܟܘܫܠܦܐ ܒܪܐ ܟܡܘܪܟܗ. ܗܢܐ ܘܕܡ ܥܡ ܡܘܚܬܘܬܐ ܕܡܓܠܠܗ ܣܘܦܗ ܟܒܝܢܐ ܨܘܪܬܐ (٥ — ٥).

ܨܘܪܬܐ (٥ - ٥)

ܘܗܕܐ ܐܚܝܘܬܐ ܡܢܐ ܪܦܝܐ ܬܘܩܦܐ ܟܡܝܢܐ ܦܝܫ ܝܪܐ ܟܬܘܩܦܐ ܕܓܡܝܫܘܬܐ ܒܕ ܡܝܐ ܕܥܒܕ ܟܘܠܠܐ ܓܘ ܕܥܒܪܗ ܠܡܘܪܟܗ ܒܪܢܐ.

ܦܝܫ ܚܘܫܒܢܐ ܬܘܩܦܐ ܕܓܡܝܫܘܬܐ ܟܦܠܓܐ ܕܬܘܦܦܐ ܕܡܫܚܐ ܕܚܝܠܐ ܓܘ ܓܪܫܬܐ ܐܘ ܚܠܨܬܐ ܕܥܟܒܟܒ ܟܡܘܦܐ ܕܪܦܝܐ ܕܟܘܐ ܚ/٢ ܟܦܦܐ ܟܟܘܢܠܐ ܕܟܘܫܠܦܐ ܕܡܘܪܟܐ ܕܡܥܟܒܟܗ ܐܘ ܚܠܨܐ.

ܘܠܦܘܬ ܩܢܘܢ ܗܘܟ ܚܝܠܐ (ܚ) ܟܐ ܡܫܘܬܐ ܩܝܡܬܐ (ܗܚ) ܟܦܦܐ ܟܟܘܫܠܦܐ ܕܡܘܪܟܐ (ܙ) ܘܦܝܫ ܡܪܐ ܐܘ ܩܝܡܬܐ ܟܡܩܝܡܬܐ ܕܚܝܠܐ ܘܟܠܐ ܥܠ ܕܠܐܬܐ ܓܘܢܐ ܕܪܦܝܐ ܒܕ ܟܝܠܦ ܟܫܠܦܬܐ ܕܪܦܝܐ ܘܡܝܬܐ ܠܗ ܡܥܒܕܬܐ ܕܐܘܐ ܩܝܡܬܐ ܕܠܗ ܟܘܢܠܐ ܕܚܝܠܐ ܐܢܝܢܐ ܠܟܒܕܬܐ ܕܪܦܝܐ ܐܘ ܠܘܥܡܐ ܚܕܐ ܐܘ ܟܝܒ ܟܟܘܢܠܐ ܕܚܪܝܢܘܬܐ ܕܡܘܪܟܐ ܘܚܪܢܘܬܐ ܕܐܘܐ ܩܝܡܬܐ (ܣܘܟ ܡܝܬܐ) ܐܘ (ܕܡ ܗܡ).

ܚ = ܗܚ ܙ .... (٥ — ٨)

ܬܘܩܦܐ ܕܓܡܝܫܘܬܐ = ܟܘܠܠܐ ܥܒܝܕܐ ܠܟܫܠܦܬܐ ܕܡܘܪܟܐ ܕܪܦܝܐ ܐܘ ܠܘܥܡܐ

ܬܘܩܦܐ ܕܓܡܝܫܘܬܐ = ١/٢ ܚ ܙ .... (٥ — ٩)

ܐܘ

ܬܘܩܦܐ ܕܓܡܝܫܘܬܐ = ١/٢ (ܗܚ ܙ) × ܙ = ١/٢ ܗܚ ܙ٢ ..... (٥ - ١٠)

ܬܘܩܦܐ ܕܣܝܡܘܬܐ ܐܝܟ ܕܒܛܠܝܐ ܠܗ ܒܡܛܪܬܐ ܐܘ ܒܢܦܩܬܐ ܐܘ ܒܫܠܡܬܐ ܕܐܘܪܚܐ ܘܦܫ ܚܘܝܒܐ ܒܗܠܝܢ ܐܝܟ ܒܐܣܢܘܬܐ ܥܒܝܕܬܐ

(٥ — ٧) ܬܘܩܦܐ ܙܘܥܝܐ Kinetic Enerfy

ܒܟܠ ܕܓܘܫܡܐ ܡܙܕܥܙܥ ܐܝܬ ܒܗ ܬܘܩܦܐ. ܘܗܢܐ ܡܬܚܙܐ ܟܕ ܢܩܫ ܒܓܘܫܡܐ ܐܚܪܢܐ. ܐܘ ܡܫܚܠܦ ܠܗ ܨܘܪܬܗ ܐܘ ܣܝܡܘܬܗ. ܐܘ ܟܕ ܥܒܕ ܥܒܕܐ ܥܠܘܗܝ. ܘܗܢܐ ܬܘܩܦܐ ܙܘܥܝܐ ܡܬܩܪܐ. ܘܬܘܩܦܐ ܙܘܥܝܐ ܕܓܘܫܡܐ ܡܬܝܕܥ ܒܡܫܘܚܬܐ ܕܡܪܗܒܘܬܗ ܘܕܡܘܬܗ ܒܕܡܘܬܐ ܗܕܐ:

$$ܬܙ = \frac{١}{٢} ܓ ܡ^{٢} \quad ...... \quad (٥ — ١١)$$

ܬܘܩܦܐ ܙܘܥܝܐ ܠܓܘܫܡܐ ܗܘ ܒܫܘܝܘܬܐ ܠܥܒܕܐ ܕܐܬܥܒܕ ܥܠ ܓܘܫܡܐ ܡܙܕܥܙܥ ܟܕ ܡܬܚܠܦ ܡܪܗܒܘܬܗ ܡܢ ܣܟܐ ܠܣܟܐ. ܐܢ ܗܘ ܕܓܘܫܡܐ ܕܡܬܝܕܥ ܒܬܘܩܦܐ ܕܚܝܠܐ ܕܥܒܕ ܥܠܘܗܝ ܡܢ ܫܘܪܝܐ ܗܢܐ ܘܥܕܡܐ ܠܐ ܗܘܐ ܡܙܕܥܙܥ ܟܕ ܠܐ ܐܝܬ ܥܠ ܚܝܠܐ ܕܙܘܥܐ ܕܓܘܫܡܐ ܘܦܫ ܒܡܘܫܚܐ ܒܡܢܝܢܘܬܐ ܕܡܪܗܒܘܬܐ ܒܗܝ ܗܝ. ܐܢ ܡܬܩܪܒ ܥܠܘܗܝ ܚܝܠܐ ܕܫܘܝܐ ܒܡܫܘܚܬܐ (ܚ) ܐܝܟ ܒܨܘܪܬܐ (٥ — ٦) ܥܠ ܓܘܫܡܐ ܒܡܫܘܚܬܐ (ܓ) ܘܡܫܚܠܦ ܠܡܪܗܒܘܬܗ ܡܢ (ܡ١) ܠ (ܡ٢) ܒܡܫܚܬܐ (ܙ) ܡܢ ܙܒܢܐ.

ܘܠܦܘܬ ܢܡܘܣܐ ܬܢܝܢܐ: $ܚ = ܓ ܣ$

$$ܣ = \frac{ܡ٢ \quad ܡ٢}{ܙ}$$



ܨܘܪܬܐ (٥ ـ ٦)

$$ܚ = ܓ \times \frac{ܡ٢ \quad ܡ٢}{ܙ}$$

$$ܘܒܕ ܡܙ = \frac{ܡ١ + ܡ٢}{٢} \times ܙ$$. (ܡܫܘܚܬܐ ܬܪܬܝܢ ܡܪܗܒܘܬܐ ܒܫܘܝܘܬܐ ܒܙܒܢܐ)

ܥܒ = ܚ ܡܘ

$$\text{ܥܒ} = \text{ܩ} \times \frac{\text{ܡ٢} - \text{ܡ١}}{\text{ܘ}} \times \frac{\text{ܡ٢} + \text{ܡ١}}{٢} \cdot \text{ܘ}$$

$$\text{ܥܒ} = \frac{1}{٢}\,\text{ܩ}\,(\text{ܡ٢}^{٢} - \text{ܡ١}^{٢})$$

$$\text{ܥܒ} = \frac{1}{٢}\,\text{ܩ}\,\text{ܡ٢}^{٢} - \frac{1}{٢}\,\text{ܩ}\,\text{ܡ١}^{٢} \quad \ldots\ldots (٥ \text{ـ} ١٢)$$

ܘܐܗܐ ܫܘܚܠܗ ܝܠܗ ܕܒܗܘܠܬܐ ܕܚܒܕܠܗ ܦܘܠܛܐ ܕܚܝܠܐ ܬܪ̈ܝܐ ܡܚܕܕܝ ܥܠ ܓܘܫܡܐ ܟܘܐ ܒܘܫܠܦܐ ܒܗܘܡܦܘ ܘܡܟܐ. ܒܗ ܣܘܟܐ ܕܦܘܠܛܐ ܕܚܝܠܐ ܗܘܐ ܫܘܦܐ ܐ. ܗܘܝ ܒܐܘܪܚܐ ܕܘܡܟܐ ܘܠܠܘܪܐ ܐ. ܗܘܝ ܦܟܝܐ ܠܐܘܪܚܐ ܕܘܡܟܐ.

ܐ. ܦܟܠܗ ܡܫܕܫܐ ܠܓܘܫܡܐ ܘܡܦܐܝܗ ܠܠܠ ܒܚܝܠܐ (ܚ) ܡܘܣܝܘܬܐ ܘܡܦܟܐ ܒܘܫܠܗ (ܡܘ) ܐܝܟ ܒܨܘܪܬܐ (٥ ـ ٧) ܦܘܠܛܐ ܒܗܘܐ

ܨܘܪܬܐ (٥ ـ ٧)

ܚ = ܚ − ܢ

ܘܒܡܫܘܚܬܐ ܕܒܘܫܠܬܐ (٥ ـ ١٢) ܒܦܠܛ:

ܥܒ = (ܚ − ܢ) × ܡܘ = ܟܘܪ ٢ − ܟܘܪ ١

ܚ ܡܘ − ܢ ܡܘ = ܟܘܪ ٢ − ܟܘܪ ١

ܒܘܠܬܐ ܚܒܝܒܐ ܠܡܫܘܚܬܐ ܕܓܘܫܡܐ ܘܡܦܐܝܗ ܟܘܐ ܒܘܫܠܦܐ ܒܗܘܡܦܘ ܘܡܟܐ + ܗܘܡܦܐ ܒܡܚܝܬܐ ܒܓܘܫܡܐ.

ܐܠܐ ܐ. ܗܘܐ ܘܡܟܐ ܕܓܘܫܡܐ ܥܠ ܒܝܬܐ ܐܘܦܩܐ ܣܕܘܦܐ ܘܒܗܘܕܗܒܐ ܡܫܒܚܐ ܐܝܟ ܒܨܘܪܬܐ (٥ ـ ٨) ܦܘܠܛܐ ܕܚܝܠܐ ܚ = ܚ ܣܝܢ ܒܒ (ܣܝܢ) ܕܡܘ ܠܚܝܠܐ ܕܣܚܒܐ ܘܒܡܫܘܚܬܐ ܕܒܘܫܠܬܐ (٥ ـ ١٢) ܒܦܠܛ

(ܚ ܟܘܪ) ܡܘ = ܟܘܪ ٢ ܟܘܪ ١

ܫ ܡܘ = ܐܙ٢ − ܐܙ١ + ܡܫ ܡܘ

ܥܡܠܐ ܟܠܢܝܐ = ܫܘܚܠܦܐ ܒܐܘܣܦܐ ܙܘܥܢܝܐ + ܥܡܠܐ ܟܠܢܝܐ ܕܠܘܩܒܠ ܚܝܠܐ ܕܫܚܩܐ

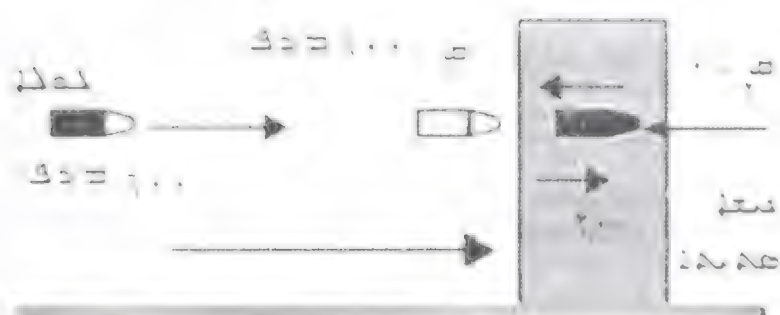
ܦܘܫܩܐ (١)

ܦܓܠܐ ܕܩܛܝܢܐ ܛܘܦܐ ܡܬܡܠܐ ٥٠ ܓܡ ܡܬܠܘܠܘܬܐ ܐܘܣܦܐ ܡܬܠܐ ٦٠٠ ܡ/ܪ ܥܠ ܩܝܣܐ ܘܡܬܥܒܪܐ ܒܗ ܡܫܚܘܬܐ ܡܬܠܐ ٢٠ ܣܡ ܡܢ ܕܡܢܬܐ ܡܢܐ ܗܘ ܡܨܥܝܐ ܕܣܘܪܒܐ ܕܩܝܣܐ؟

ܫܪܝܐ

ܫܘܚܠܦܐ ܒܐܘܣܦܐ ܙܘܥܢܝܐ ܕܦܓܠܐ = ܥܡܠܐ ܟܠܢܝܐ ܥܠ ܣܘܪܒܐ ܕܩܝܣܐ

ܐܙ٢ − ܐܙ١ = ܫ ܡܘ



ܣܟܡܐ − $\frac{1}{2}$ ܓ ܡ١ ^{2} = ܫ ܡܘ

$\frac{١}{٢} \times \frac{٥٠}{١٠٠٠} \times ٣٦٠٠٠٠ = ܫ \times \frac{٢٠}{١٠٠}$

ܨܘܪܬܐ (٥ ـ ٨)

ܫ = − ٤٥٠٠٠ ܢܝܘܛܢ ܘܪܡܙܐ ܕܠܐ ܡܚܘܐ ܕܣܘܪܒܐ ܕܩܝܣܐ ܗܘܐ ܒܦܘܚܐ ܠܘܩܒܠ ܪܗܛܐ.

ܦܘܫܩܐ (٢)

ܡܬܬܥܒܕܐ ܚܝܠܐ ܡܬܠܐ ٢ ܢܝܘܛܢ ܥܠ ܓܘܫܡܐ ܛܘܦܐ ܡܬܕܥܐ ܚܝܠܐ ܕܫܚܩܐ ܕܢܓܕܐ (٠،٥) ܢܝܘܛܢ. ܘܡܫܚܠܦܐ ܡܬܠܘܠܘܬܗ ܡܢ (٤ ܡ/ܪ) ܠ (٦ ܡ/ܪ) ܒܙܒܢ ܕܡܬܥܒܕܐ ܡܫܚܘܬܐ ܡܬܠܐ 8ܡ ܒܪܘܚܐ ܕܗܘ ܚܝܠܐ ܡܢܐ ܗܘ ܡܬܠܐ ܕܥܡܠܐ ܕܡܬܥܒܕ ܗܘ ܚܝܠܐ؟

ܫܪܝܐ

ܥܡܠܐ ܕܡܬܥܒܕ ܚܝܠܐ = ܡܬܠܐ ܫܘܚܠܦܐ ܙܘܥܢܝܐ ܕܓܘܫܡܐ + ܥܡܠܐ ܟܠܢܝܐ ܕܠܘܩܒܠ ܚܝܠܐ ܕܫܚܩܐ

$$= \frac{1}{2}\,\text{ܩ ܡ}_{٢}^{٢} - \frac{1}{2}\,\text{ܩ ܡ}_{١}^{٢} + \text{ܣܣ ܡܘ}$$

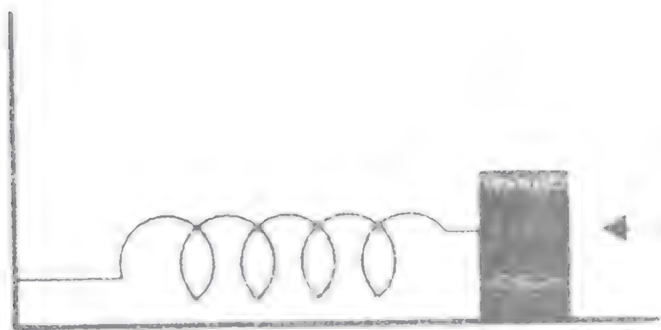
$$= \frac{1}{2} \times ٢ \times ٣٦ - \frac{1}{2} \times ٢ \times ١٦ + ٠٫٥ \times ٨$$

$= ٣٦ - ١٦ + ٤$

$=$ ٢٤ ܓܘܠ

ܡܘܦܬܐ (٣)

ܓܘܫܡܐ ܡܬܩܠܗ ٤ ܟܝܠܘ ܓܪܡܐ ܒܣܘܪܥܐ ܕܪܗܛܐ ܫܠܝܘܬܐ ܐܘܦܩܝܐ ܡܬܬܟܐ ܕܣܠܩܐ ܢܘܐ $١٠^{٥}$ ܕܝܢ ܡܛ ܢܦܠܐ ܥܠ ܢܪܫܐ ܐܘܦܩܝܐ ܢܟܝܬܐ ܘܗܝ ܦܬܠܗ ܡܘܠܬܐ ܡܘܦܬܐ ܐܣܪܬܐ ܡܢ ܪܦܝܐ ܒܓܘܪܐ ܘܡܚܠܐ ܐܝܟ ܕܐܡܚܘܝܬܐ (٥ — ٩) ܟܡ ܦܬܠܗ ܡܟܝܬܐ ܪܦܝܐ ܡܘܣܝܒܘܬܐ (١٠ ܣܡ) ܟܡܐ ܠܗ ܡܠܘܠܘܬܐ ܡܨܝܕܬܐ ܕܡܢܐܠܗ ܐܢܐ ܓܘܫܡܐ ܓܘ ܡܪܡܪܐ ܕܣܠܩܐ ܟܟܬܪܐ ܡܢܗ؟



ܐܣܟܡܐ (٥ - ٩)

ܚܪܝܐ

ܣܘܦܐ ܕܪܡܝܘܬܐ ܟܪܦܝܐ = ܣܘܦܐ ܘܡܟܐ ܕܡܢܐܠܗ ܟܡܐܬܐ

$$= \frac{1}{2}\,\text{ܡܠ ܡܘ}^{٢} = \frac{1}{2}\,\text{ܩ ܡ}^{٢}$$

$$\text{ܡܠ} = ١٠^{٥}\,\frac{\text{ܕܝܢ}}{\text{ܣܡ}} = \frac{١٠^{٥} \times ١٠^{-٥}}{١٠^{-٢}} = ١٠٠\ \text{ܢܝܘܛܢ/ܡ}$$

$$\frac{1}{2} \times ١٠٠ \times \left(\frac{١٠}{١٠٠}\right)^{٢} = \frac{1}{2} \times ٤\ \text{ܡ}^{٢}$$

$\text{ܡ} = ٠٫٥\ \text{ܡ/ܪܦ}$

(٥ — ٨) ܩܢܘܢ ܢܛܘܪܬܐ ܕܗܘܡܦܐ

ܕܝܕܥܠܢ ܒܕܒܕܒܪܐ ܕܠܗܘܡܦܐ ܙܘܕܢܬܐ ܕܟܝܐ ܐܝܟ ܗܘܡܦܐ ܘܡܟܢܐ ܘܡܡܢܝܐ ܘܡܡܢܐ ܘܡܘܕܥܢܐ ܘܡܣܡܣܘܬܐ ܘܢܘܗܪܐ ܘܙܘܥܝܬܐ ܐܣܕܢܐ ܕܟܝܐ ܐܦ ܕܡܘܬܠܐ ܦܝ ܣܝܒܪܐ ܡܢ ܙܘܕܢܬܐ ܕܗܘܡܦܐ ܠܦܘܬ ܡܫܬܚܠܦܢܘܬܐ ܣܕܪܐ ܘܡܘܬܠܐ ܦܝ ܟܠܐ ܡܢܐ ܕܝܠܗ ܠܡܡܠܠܘ ܡܢ ܗܘܡܦܐ ܘܡܘܦܩܐ ܒܗ ܦܝ ܒܘܣܟܠܠܘ ܐܢܐ ܡܫܬܚܠܦܢܘܬܐ ܕܟܝܐ ܒܗ ܦܘܪܐ ܣܒܪܐ (ܢܘܗܪܐ) ܒܙܘܕܪܐ ܕܝܠܝܬܐ ܐܝܟ ܒܒ ܕܒܣܠܘ ܒܗܕ ܥܠܠ ܡܕܝܢܬܐ ܠܘ ܕܡܙܝܢܬܐ ܠܘ ܠܚܕܕܐ ܕܕܘܒܪܐ ܕܡܘܬܠܐ ܗܘܡܦܐ ܘܡܟܢܐ ܒܗ ܥܕܢܬܐ ܕܡܦܠܣܬܐ ܒܚܠܠܬܐ ܕܗܘܡܦܐ ܒܣܕܪܐ ܦܠܝܛܐ ܡܢ ܦܘܠܠܐ ܒܡܡܢܐ ܠܘܗ ܘܣܘܦܐ ܒܣܝܐ ܒܗܘܢܐ ܕܡܣܒܬܐ ܕܣܘܦܐ ܒܗ ܡܛܘܢܐ ܕܡܡܢܐ ܐܝܬܠܗ ܗܘܡܦܐ ܚܒܝܠܘ ܡܙܝܢܐ ܡܢ ܙܟܦܬܐ ܕܡܚܒܒܐ ܘܡܘܬܠܒܬܐ ܕܗܘܡܦܐ ܘܡܟܢܐ ܠܘܗ ܒܡܕ ܕܐܘܐ ܦܝ ܒܘܡܘܐ ܘܣܘܦܐ ܕܗܘܡܦܐ ܒܡܢܘ. ܕܟܝܐ ܐܢܘܢܐ ܦܝ ܡܕܢܐ ܒܡܢܘ. ܢܛܘܪܬܐ ܕܗܘܡܦܐ ܘܣܒܒ ܒܠ ܗܘܡܦܐ ܠܐ ܡܘܒܒ ܘܠܐ ܦܝ ܒܕܢܐ ܐܠܐ ܦܝ ܡܒܘܣܠܦܐ ܡܢ ܙܘܕܢܬܐ ܠܐܣܕܢܐ ܘܐܘܐ ܗܘܦܠܘ ܥܠܘ ܕܐ. ܒܕܐܠܘ ܒܙܘܕܪܐ ܒܣܒ ܙܘܕܢܬܐ ܕܗܘܡܦܐ ܘܠܐ ܕܒܕܢܐ ܘܝܒܬܐ ܒܙܘܕܪܐ ܐܣܕܢܬܐ ܡܐ ܒܘܦܘܫܐ ܠܘܒܬܐ ܕܕܡܒܪܐ ܢܕܠܢܐ ܐܝܟ ܕܒܐܣܟܡܐ (٥ — ١٠) ܐܝܬܠܘ ܗܘܡܦܐ ܡܡܢܐ ܐܡܬ ܕܗܘܐ ܒܢܘܡܘܬܐ ܒܝ ܥܠܝܬܐ ܡܢ ܡܙܘܠܘ ܘܟܘܐ ܢܘܡܪܐ ܕܠܘܒܬܘ ܚܦܝܦܐ ܒܡܙܝܢܘܬܐ ܘܡܦܬܐ ܡܢ ܒܘܦܐ ܕܒܠܘܬܐ ܒܝܕ ܐܘܐ ܗܘܡܦܐ ܢܣܠܒ ܡܢܐ ܗܘܡܦܐ ܘܡܟܢܐ ܘܝܕܢܐ ܥܠ ܕܡܛܠܢܐ ܠܘܒܬܐ ܠܢܘܡܘܬܐ ܒܝ ܒܘܦܬܐ ܘܐܘܐ ܗܘܡܦܐ ܡܡܢܐ ܒܘܣܠܦܐ ܒܠܘ ܠܗܘܡܦܐ ܘܡܟܢܐ ܐ. ܒܡܒܠ ܒܘܙܢܐ ܕܦܘܣܐ ܘܣܠܐ ܐܣܕܢܐ ܡܚܕܘܠܝܐ. ܒܡ ܒܕܐ ܗܘܡܦܐ ܘܡܟܢܐ ܒܙܘܕܐ ܢܣܠܒ ܘܡܢܐ ܠܘܒܬܐ ܗܘܡܦܐ ܡܡܢܐ ܡܢ ܠܒܬܘ ܥܠ ܕܡܛܠܢܐ ܠܕܡܘܬܐ ܡܕܡܝܬܐ ܡܢ ܠܒܬܐ ܐܣܕܢܐ ܘܐܘܐ ܗܘܡܦܐ ܘܡܟܢܐ

ܐܣܟܡܐ (٥ ـ ١٠)

ܒܠܘ ܒܘܣܠܦܐ ܠܗܘܡܦܐ ܡܡܢܐ ܒܕ ܢܒܬܐ ܕܒܘܒܢܐ ܕܗܘܡܦܐ ܘܡܟܢܐ ܘܡܗܘܡܦܐ ܡܡܢܐ ܠܠܘܒܬܐ ܒܚܠ ܢܘܡܘܬܐ ܡܢ ܡܙܘܠܘ ܟܘܐ ܒܘܠܐ ܡܕܝܬܐ ܘܐܘܐ ܒܘܢܐ

ܠܬܘܩܦܐ ܩܡܝܬܐ ܒܚܘܩܘܬܐ ܒܝ ܠܟܠ ܡܢ ܡܬܝܠܗ ܘܠܐ ܩܘܐ ܬܘܩܦܗ ܘܡܚܝܠܐ ܒܚܘܩܘܬܐ ܒܝ ܬܘܦܬܐ ܗܝܢܘ.

ܘܡܢ ܠܫܡܘܢܬܐ ܐܚܪܢܐ ܕܩܢܘܢ. ܢܛܪܬܐ ܕܬܘܩܦܐ ܗܝ ܕܫܘܚܠܦܘ ܠܗ ܡܫܠܡܬܐ ܕܬܘܩܦܐ ܘܡܚܝܠܐ ܠܗ ܐܚܪܬܐ ܒܚܘܠܠܐ ܕܩܘܡܐ ܚܠܐ ܕܫܚܬܐ ܒܝ ܟܠܐ ܬܘܩܦܐ ܕܚܡܝܡܘܬܐ ܡܢ ܠܒܪ ܘܐܬܪܐ ܕܠܒܝ ܘܦܬܐ ܒܝ ܡܫܠܡܬܐ ܕܬܘܩܦܐ ܕܚܡܝܡܘܬܐ ܐܬܪܐ ܕܟܠܐ ܬܘܩܦܐ ܘܡܚܝܠܐ ܡܢ ܠܒܪܘ.

ܘܡܛܠܗ ܢܕܘܥܐ ܠܗܘܠ ܗܫܬܐ ܕܐܫܬܘܬܐ ܡܫܘܬܦܢܘܬܐ ܒܝܢ ܬܘܩܦܐ ܡܟܢܝܟܝܐ ܘܬܘܩܦܐ ܕܚܡܝܡܘܬܐ ܘܫܡܠܗ ܠܡܩܒܠܬܐ ܕܫܡܗ ܓܠܕܝ ܓܠܕܐ ܚܒܪܬܐ ܕܒܘܓܠܐ ܒܓܝܠܗ (٤٫١٨٦ ܓܘܠ ܐܘ ٤٫٢ ܓܘܠ ܡܘܕܪܢܐܝܬ) ܘܦܝܫ ܡܢܐ ܐܝܟ ܗܕܐ ܒܠܘܩܒܠ ܓܘܠ ܒܡܕ ܕܐܝܟ ܒܘܢܐ:

ܬܘܩܦܐ (ܒܓܠܠܐ ܒܓܘܠ) = ܠܡܩܒܠ ܕܓܘܠ × ܟܡܝܘܬܐ ܕܚܡܝܡܘܬܐ ܒܟܠܘܪܝ

(٥ — ٩) ܩܢܘܢ ܢܛܪܬܐ ܕܬܘܩܦܐ ܘܟܘܬܠܐ

ܠܐܝܬ ܐܟܒܪܐ ܫܡܥܠܗ ܢܕܘܥܐ ܕܟܘܬܠܐ ܗܕܐ ܡܠܗ ܠܐ ܟܫܠܦ ܒܝ ܠܐ ܡܠܗ ܡܫܬܢܝܬܐ ܒܕܡܘ ܡܢ ܠܐ ܡܝܕܡ ܘܠܐ ܡܠܗ ܡܫܬܢܝܬܐ ܕܐܘܠ ܡܢ ܠܐ ܡܝܕܡ ܘܡܘܬܒܠܗ ܩܢܘܢܐ ܕܩܝܡܐ ܠܩܢܘܢ. ܢܛܪܬܐ ܕܬܘܩܦܐ ܦܫܠܗ ܡܢܐ ܒܩܢܘܢ. ܢܛܪܬܐ ܕܟܘܬܠܐ. ܐܢܐ ܗܟܝܢ ܙܘ ܠܡܫܠܡܗ ܕܟܘܬܠܐ ܘܬܘܩܦܐ ܗܕܝ ܗܘ ܡܠܐ ܦܫܝܛܐ ܥܠ ܕܡܫܬܠܗ ܢܕܘܥܐ ܘܡܢ ܗܒܝܠܗ ܝܡܝܢܐ ܡܠܦܢܐ ܕܐܝܟ ܗܘܐ ܐܫܬܘܝܘܬܐ ܒܝܢ ܟܘܬܠܐ ܘܬܘܩܦܐ ܘܐܘܫܝܠܗ ܢܕܘܥܐ ܐܝܢܫܬܝܢ ܗܘܐ ܐܫܬܘܝܘܬܐ ܫܢܬܐ ١٩٠٥ ܐܝܟ ܕܐܬܐ:

ܫܘܚܠܦܐ ܒܬܘܩܦܐ ܕܠܘܬܗ = ܫܘܚܠܦܐ ܒܟܘܬܠܗ × ܡܪܒܥܐ ܕܩܠܝܠܘܬܐ ܕܢܘܗܪܐ

ܐܢܝ ܗܟܝܢ Δ ܬܘ = Δ ܟ ܩܠ٢ .... (٥ — ١٤)

ܬܘܩܦܐ ܗܢܐ ܡܠܗ ܒܓܘܠ ܘܟܘܬܠܐ ܒܟܝܠܘ ܘܩܠܝܠܘܬ ܢܘܗܪܐ ܠܗ ܫܘܝܐ ܒܡܫ ٣ × ١٠^٨ ܡ/ܫ. ܘܡܛܠܬܐ ܠܐܝܬ ܫܘܝܘܢ ܕܟܘܬܠܐ ܘܬܘܩܦܐ ܗܕܝ ܙܘܕܬܐ ܡܠܗ ܠܫܒ ܡܝܕܡ ܘܡܫܬܢܝܬܐ ܡܠܗ ܟܫܠܦܬܐ ܕܫܒ ܩܢܘܢ ܠܐܚܪܢܐ. ܘܠܐܝܬܐ ܩܠܐ ܕܩܡܘܫ ܕܟܘܬܠܐ ܡܠܗ ܡܬܘܚܕܬܐ ܒܬܚܬܐ ܠܐ ܐܫܬܘܬܐ ܘܡܠܗ ܗܕܐ ܠܗ ܝܠܘܬܐ ܐܠܐ ܟܫܠܦ ܒܫܘܠܦܬܐ ܕܡܠܘܠܘܬܐ.

ܚܠܝܦܬܐ ܕܚܘܝܠܐ ܕܠܘܩܛܪܘܢܐ ܒܬܠܘܬܢܬܐ ܠܡܕܝܢܐ ܗܘܐ ܪܒܐ ܘܡܪܒܐ
ܘܡܫܘܚܬܐ ܠܝܗ ܟܘܢ ܕܠܐ ܗܘܐ ܡܫܘܚܬܐ ܕܝܠܗ . ܐܠܐ ܐܝܟ ܕܦܫܛܐ ܐܘܠܘܬܐ
ܠܟܘܡܬܐ ܡܕܒܪܐ ܡܢ ܬܠܘܠܘܬܐ ܕܟܘܪܐ ܒܟܒܕ ܒܘܫܠܦܐ ܡܘܒܠܬܐ ܒܟܘܡܠܐ
ܐܦ ܡܘܫܘܐܠܗ ܠܐܘܐ ܢܗܝܪܐ ܘܠܦܬܐ ܥܠ ܠܘܫܡܘܢܐ ܡܕܡܐ ܐܝܟ ܦܟܘܬܘܢܐ
ܘܢܘܬܟܘܢܐ ܘܐܠܟܬܟܘܢܐ ܡܫܒܚܐ ܒܬܠܘܠܘܬܐ ܕܟܬܐ ܘܠܘܫܡܐ ܕܟܘܡܠܗ ܠܗ
ܒܠܘܬܐ (ܓ) ܡܫܘܚܬܐ ܕܝܠܗ ܫܪܝܪܬܐ ܕܟܘܡܠܗ (ܓ ܗ) ܒܟܕܪܐ ܕܘܡܠܐ
ܒܙܘܠܘܬܐ (ܗ) ܡܢ ܐܫܟܘܬܐ

$$ܓ\ ܫ = \frac{ܓ}{\sqrt{1 - \frac{ܗ^{2}}{ܡܒ^{2}}}} \quad \ldots\ldots (١٥ — ٥)$$

ܣܢܐ ܗܘܐ ܡܢ ܬܘܡܠܬܐ ܕܒܘܫܠܦܐ ܕܟܕܐܠܗ ܒܟܘܡܠܐ ܒܠܠܬܐ ܕܝܣܒܬܐ
ܕܬܠܘܠܘܬܐ ܗܘܐ ܡܫܘܕܐ ܗܠ ܕܡܕܒܪܐ ܬܠܘܠܘܬܐ ܡܢ ܬܠܘܠܘܬܐ ܕܟܘܪܐ ܗܝܠܗ
ܒܘܐ ܟܘܡܠܐ ܒܘܝܒܬܐ ܬܠܘܠܬܐ.
ܐܠܐ ܐ . ܦܟܠܗ ܬܠܘܠܘܬܐ ܕܠܘܫܡܐ ܒܘܐ ܬܠܘܠܘܬܐ ܕܟܘܪܐ ܗܝܠܗ ܗܠܐ
ܕܦܫ ܟܘܡܠܐ ܠܐ ܒܘܠܫܡܐ. ܘܟܘܡܠܐ ܠܐ ܒܘܠܫܡܐ ܗܢܘ ܠܣܠܐ ܠܐ ܒܘܠܫܡܐ ܗܠ
ܕܗܕܗܟܠܗ ܘܣܠܐ ܠܐ ܒܘܠܫܡܐ ܠܗ. ܠܠܗܐ ܝܠܗ ܕܠܐ ܝܠܗ ܡܫܘܚܬܐ
ܗܕܗܟܬܐ ܕܠܘܫܡܐ ܘܡܫܠܡܐܗ ܠܬܠܘܠܘܬܐ ܕܟܘܪܐ ܣܘܣ ܡܢ ܕܐܗܐ ܕܐܝܢ
ܟܕܐ ܝܒܬܐ ܕܬܠܘܠܘܬܐ ܠܝܒܬܐ ܕܟܘܡܠܐ ܗܢܐ ܘܕܢ ܕܐܝܢ ܒܫܠܦ ܬܘܡܦܐ
ܠܟܘܡܠܐ.
ܡܐ ܝܘܦܩܐ ܐܠܟܬܟܘܢܐ ܐܘܠܝܐ ܝܠܗ ܐܒܘܟܐ ܕܗܕܟܐ ܕܬܠܟܝܡܘ. ܐܘܠܝ
ܒܬܠܘܠܘܬܐ ܕܬܘܡܠܬܐ ܕܬܠܘܠܘܬܐ ܕܟܘܪܐ ܡܕܒ ܠܒܦܟܡܗ ܒܗܕܐ.
ܘܟܠܡܫܬܐ ܕܬܘܡܠܬܐ ܝܟܝܒܬܐ ܒܣܘܣ ܕܟܘܡܠܐ ܕܐܠܟܬܟܘ. ܕܟܘܡܠܗ ܝܠܗ
ܒܠܘܬܐ ٩،١ × ١٠ $^{-٣١}$ ܟܝܡ ܦܝܫ ٩،٦ × ١٠ $^{-٣}$ ܟܝܡ. ܘܐܢܝܢܐ ܒܣܘܣ
ܕܟܘܡܠܐ ܕܐܠܟܬܟܘ. ܠܐ ܐܝܟ ܐܠܐ ܒܟܘܡܠܐ ܘܟܘܪܐ ܐܦ ܕܬܠܘܠܘܬܐ ܠܟܘܪܬܐ
ܝܠܗ ܘܐܦ ܗܝܡܐ ܝܠܗ ܠܣܘܐ ܕܦܫܐ ܒܫܠܦ ܡܢ ܟܘܡܠܐ ܠܬܘܡܦܐ ܠܦܘܬ
ܬܘܡܠܬܐ

$$ܬܘ = \Delta\ ܓ\ ܡܒ^{٢}$$

ܒܠܗ ܗܘܡܐ ܘܟܘܪܐ ܡܢ ܒܘܬܐ ܥܠܡܝܐ. ܘܐܘܡܬܐ ܕܚܕ ܡܦܩܬܐ ܐܘ ܒܘܡܬܐ ܢܘܟܪܝܐ ܦܠܛ ܡܢ ܒܘܬܐ ܪܒܐ ܘܟܘܪܐ ܡܢ ܒܘܬܐ ܚܠܝܐ ܠܡܫܘܬܐ ܠܒܘܪܐ ܡܢ ܐܘܡܬܐ.

ܡܢ ܓܘܦܐ ܐ. ܦܪܠܝܘ ܡܘܡܕܐ ܓܒܐ ܡܬܪܢܐ ܡܢ ܚܣܪܐ ܠܒ (١٦) ܫܢܐ ܡܬܪܢܐ ܡܢ ܐܘܡܓܝܢ ܒܠܘ ܗܘܡܐ ܦܠܛܐ ܒܢܡܚܡܐ ܕܡܡܡܘܬܐ ܐܘ ܒܘܪܐ ܒܡܬܚܐ ܕܡܘܟܪܢܘܬܐ ܕܡܝܕܬܐ ܚܕܡ ܠܦܠܛܐ ܕܘܠܐ ܕܡܝܕܬܐ ܒܟ ܒܓܘܪܐ ܡܢ ܟܡܪܢ ܘܪܢ ܓܒܐ ܒܒܘܬܐ ٢٠٠٠ ܟܡ ܟܠܣܘܕ ܐܠܐ ܟܘ ܦܘܟܠܐ ܢܘܟܪܝܐ ܐܘܐ ܦܣܡܘܬܐ ܟܪܘܦܐ ܘܟܪܝܐ ܕܡܓܢܝܐ ܠ ١ % ܡܢ ܒܘܬܐ ܥܠܡܝܐ ܐܝܟ ܕܒܪܐ ܟܘ ܒܘܡܟܐ ܝܪܢܐ ܘܐ. ܝܕܟܠܘܢ ܕܡܟܢܐ ܕܐܘܡܬܘ ܦܠܛܐ ܝܠܗ ܡܢ ܦܘܟܠܐ ܢܘܟܪܝܐ ܡܓܠܡܐ ܡܢ ܒܘܬܐ ܡܘܪܒܐ ٤.٤ ܡܠܝܘ. ܓܒܐ ܒܪܦܦܐ ܐܠܡ ܠܒܘܪܘܬܐ ܕܐܘܡܬܐ ܦܠܛܐ ܡܢ ܟܡܬܐ ܡܢ ܕܐܘܐ ܡܣܘܦܐ ܝܠܗ ܕܡܢܘ. ܝܟܪܬܐ ܕܐܘܡܬܐ ܟܪܝܐ ܘܠܐ ܚܣܠܦܬܘ ܠܚܣܠܬܐ ܕܢܬܝܐ ܒܘܢܝܐ ܥܠܡܝܐ ܠܒܘܬܐ ܘܐܘܡܬܐ ܕܟܠ ܓܒܬܐ ܒܡܝܬܐ ܒܘܬܐ ܗܡܝܕܐ ܝܠܗ).

ܫ̈ܘܐܠܐ

ܫ١ : ܓܒܝ ܠܦܘܢܝܐ ܫܪܝܪܐ ܒܟܠ ܚܕ ܡܢ ܗܢܐ ܕܐܬܐ:

١ . ܠܦܘܬ ܡܢܘ ܢܛܪܬܐ ܕܗܘܦܟܐ ܗܘܦܟܐ:

ܐ) ܠܐ ܦܝܫ ܒܪܝܐ ܘܠܐ ܡܘܒܕ ܒ) ܡܘܒܕ ܘܠܐ ܦܝܫ ܒܪܝܐ

ܓ) ܡܘܒܕ ܘܦܝܫ ܒܪܝܐ ܕ) ܠܐ ܦܝܫ ܡܘܒܕܐ ܘܠܐ ܒܪܝܐ

٢ . ܚܕܐ ܡܢ ܚܕܝܘܬܐ ܕܪܗܛ ܠܐ ܗܠܝܢ ܚܕܝܘܬܐ ܕܡܫܘܬܐ

ܐ) ܓܘܠ . ܪܦܦܐ ܒ) ܢܝܘܛܢ . ܡ ܪܦ

ܓ) ܘܦ ܕ) ܗܘܦܐ

٣ . ܡܐ ܕܝܬܒܝܢ ܠܓܘܫܡܐ ܪܒܝ ܒܡܠܘܠܘܬܐ (ܡ) ܒܡܫܒܫܒܘܬܐ ܕܫܠܝܐ (ܫ) ܡܫܘܬܐ ܒܘܗܐ :

ܐ) ܫ ܡ ܒ) $\frac{١}{٢}$ ܫ ܡ^{٢}

ܓ) $\frac{ܫ}{ܡ}$ ܕ) $\frac{ܫ}{ܡ^{٢}}$

٤ . ܒܘܬܠܐ ٢ ܟܓܡ ܦܬܠܘ ܡܘܪܡܐ ܚܕ ܡܫܬܐ ܡܢ ܐܪܥܐ ܒܡܫܚܐ (٥٠) ܕܦܦܐ ܒܘ ܓܠܐ ܟܝܢܐ ܠܗ

ܐ) ܣܦܝܪܐ ܒ) (٢٠) ܓܘܠ

ܓ) (١٠٠) ܓܘܠ ܕ) (٩٨٠) ܓܘܠ

٥ — ܪܕܝܬܐ (ܐ) ܒܘܬܠܗ (١٠٠٠) ܟܓܡ ܘܡܠܘܠܘܬܗ (٦٠ ܟܡ ܒܫܥܬܐ) ܘܪܕܝܬܐ ܐܚܪܬܐ (ܒ) ܒܘܬܠܗ (٢٠٠٠) ܟܓܡ ܘܡܠܘܠܘܬܗ (٣٠ ܟܡ ܒܫܥܬܐ) ܗܘܦܐ ܘܡܟܝܠ ܠܪܕܝܬܐ (ܐ):

ܐ) ܦܠܓܐ ܕܗܘܦܐ ܘܡܟܝܠ ܕܪܕܝܬܐ (ܒ).

ܒ) ܬܪܝܢ ܠܗܘܦܐ ܘܡܟܝܠ ܕܪܕܝܬܐ (ܒ)

ܓ) ܟܦܠܐ ܕܗܘܦܐ ܘܡܟܝܠ ܕܪܕܝܬܐ (ܒ)

ܕ) ܐܪܒܥܐ ܓܘܐܐ ܕܒܘܬܠܐ ܕܗܘܦܐ ܘܡܟܝܠ ܕܪܕܝܬܐ (ܒ)

٦ . ܚܘܝܠܐ ܠܘܡܫܠܡܢܐ ܠ (٦ ܡܠܝܘܢ ܟܝܠܘ) ܗܘ :

ܐ) $(٦,٧ \times ١٠^{-١١})$ ܢܝܘܛܢ   ܒ) $(٤,٥ \times ١٠^{-٩})$ ܢܝܘܛܢ

ܓ) $(٦,٧ \times ١٠^{-٣})$ ܢܝܘܛܢ   ܕ) (٢×١٠^{-٢}) ܢܝܘܛܢ

٧ . ܚܘܝܠܐ (١ ܢܝܘܛܢ) ܐܝܟܠܗ ܗܘܡܦܐ ܘܡܫܬܐ (١) ܟܝܠܘ ܐܝܟ ܕܗܘܐ ܐܪܦܠܘܬܗ :

ܐ) (٠,٤٥) ܡ/ܪܬ   ܒ) (١) ܡ/ܪܬ

ܓ) (١,٤) ܡ/ܪܬ   ܕ) (٤,٤) ܡ/ܪܬ

٨ . ܚܘܝܠܐ (١) ܢܝܘܛܢ ܐܝܟܠܗ ܗܘܡܦܐ ܚܡܫܐ (١) ܟܝܠܘ ܠܦܘܬ ܐܪܥܐ ܐܝܟ ܕܗܘܐ ܐܪܦܠܘܬܗ ܡܢ ܡܝܬܝܢܐ ܕܐܪܥܐ :

ܐ) (٠,١) ܡܝܛܪ   ܒ) (١) ܡܝܛܪ

ܓ) (٩,٨) ܡܝܛܪ   ܕ) (٣٢) ܡܝܛܪ

٩ . ܝܘܩܪܐ (١) ܢܝܘܛܢ ܐܝܟܠܗ ܗܘܡܦܐ ܚܡܫܐ ܠܦܘܬ ܐܪܥܐ ܐܝܟ ܕܗܘܐ ܐܪܦܠܘܬܗ ܡܢ ܡܝܬܝܢܐ ܕܐܪܥܐ :

ܐ) (٠,١٠٢) ܡܝܛܪ   ܒ) (١) ܡܝܛܪ

ܓ) (٩,٨) ܡܝܛܪ   ܕ) (٣٢) ܡܝܛܪ

١٠ . ܒܐܝܟܢܘܬܐ ܚ = ܓ ܡܛ ^{٢} ܘܩܪܘܒܐ ܡܢ ܓܠܝܐ :

ܐ) ܐܪܦܠܘܬܐ ܕܓܘܫܡܐ   ܒ) ܐܪܦܠܘܬܐ ܕܡܠܐ

ܓ) ܐܪܦܠܘܬܐ ܕܐܪܥܐ   ܕ) ܚܠܝܨ ܚܝܠܐ ܕܐܪܥܐ

ܫ٢ : ܡܠܝ ܠܣܦܝܩܘܬܐ ܕܐܬܝ :

١ . ... ܡܠܐ ܡܬܩܪܝܐ ܚܝܠܐ ܕܐܪܥܢܘܬܐ.

٢ . ܟܠ ܕܓܘܫܡܐ ܕܓܘܫܡܐ ܚܡܫܐ ܗܘܡܦܐ

٣ . ܠܐ ܪܝܒ ܗܘܡܦܐ ܕܓܘܫܡܐ ܐܠܐ ܐܝ.

٤ . ܚܝܠܐ ܠܐ ܟܬܒ ܡܘܟܠܐ ܐܝ ܗܘܐ ܘܡܝܬܐ ܒܝܢ ܚܝܠܐ ܘܡܬܚܝܠܢܘܬܐ ܒܗܘܢ

٥ . ܐܝ ܚܝܒܠ ܕܓܘܫܡܐ ܕܚܝܠܗ ܒܡܬܠܘܬܐ ܕܐܪܥܐ ܚܘܝܠܐ ܒܟܢ.

ܬ ٣ : ܟܪܪ ܕܟܘܠܠܐ ܕܟܪܝܟܠܗ ܣܠܐ ܥܠ ܠܘܟܡܐ ܘܝܕ ܥܠ ܥܠܡܐ ܐܘܦܡܐ
ܥܒܠܐ ܬܘܐ ܥܘܣܠܦܐ ܟܗܘܦܐ ܘܡܠܐ .

ܬ ٤ ܡܣܘܝ ܕܠܘܟܡܐ ܕܐܝܟܠܗ ܟܘܦܐ ܘܡܠܐ ܐܝܟܠܗ ܣܘܡܢܐ ܟܕܪܢܐ
ܟܢܗ

ܬ ٥ ܠܡܐ ܥܣ ܡܗܠܢܐ ܦܪܠܢܐ ܐ. ܦܥܠܗ ܡܣܢܐ ܡܣܢܕܐ ܡܠܘܠܕܐ ܕܟܐ
ܠܗܘܐ ؟.

ܟܘܐܠܐ ܕܐܬܝ ܣܟܘܒ ܕܥܡܘܬܐ ܕܗܘܪܘܒܐ ܐܪܒܥܐ = ١٠ ܡ ܪܒ ٢
ܬ ٦ ܦܥܠܗ ܪܘܦܐ ܠܘܟܡܐ ܟܗܘܒܘܬܐ ܕܥܠܡܐ ܕܐܪܒܥܐ ܟܡܠܘܠܘܬܐ ٣٠
ܡ ܪܒ ܐ. ܟܘܒܐ ܕܣܢܕܐ ܟܡ ܠܘܟܡܐ ܘܐܪܒܥܐ ٠،٢٥ ܟܡܐ ܠܗ ܡܘܣܢܘܬܐ
ܕܡܗܝܠܠܗ ܠܘܟܡܐ ܗܠ ܕܟܠܐ ؟ ܦ : ١٨٠ ܡ

ܬ ٧ : ܡܘܟܒܕܠܗ ܣܠܐ ܠܪܒܢܐ ܟܘܢܠܗ ١٦ ܢܘܦܐ. ܘܠܝܢܐ (٦٠ ") ܡܢ
ܐܘܦܡܐ ܥܠ ܠܘܟܡܐ ܟܘܐܠܗ ٨ ܟܠܡ ܐܟܣ ܡܠܘܠܘܬܐ ܕܠܘܟܡܐ ܟܐܪ ܘܟܗ
٣٢ ܡ ܡܢ ܥܠܘܬܐ. ܟܟܢܘܬܐ ܕܣܢܕܐ. ܦ : ٨ ܡ ܪܒ

ܬ ٨ ܠܟܦܠܗ ܠܘܠܐ ܟܘܐܠܗ ١٨٠ ܠܒܡ ܐܘܦܡܢܒܐ ܘܟܡܠܘܠܘܬܐ ٣٦
ܡ ܪܒ ܟܟܘܐܠܐ ܡܢ ܡܢܐ ܘܥܠܐܠܗ ܥܠ ܟܘܡܡܐ ٦ ܡܢ ܠܗ ܡܢܐ ܐܟܣ
ܐ - ܡܝܢܐ ܕܟܘܪܢܐ ܕܡܢܐ ܠܠܘܠܐ.
ܒ - ܪܒܢܐ ܕܡܠܝܟܠܗ ܠܘܠܐ ܠܗ ܡܢܐ ܗܠ ܕܟܠܐ.
ܦ : 1944 ܢܘܦܐ : $\frac{١}{٣٠٠}$ ܪܦܦܐ

ܬ ٩ : ܪܡܢܐ ܟܘܐܠܐ ܕܠܘܒܗ ܓ) ܘܡܘܪܢܐ ܕܠܒܗ (٤٠) ܡܢ ܦܥܠܗ
ܠܪܟܐ ܠܘܒܗ ܠܠܒܢܐ ܗܘ ܕܗܘܪܝܠܗ ܠܪܐ (٦٠ ") ܠܡ ܘܡܦܐ ܡܢ ܦܥܠܗ
ܥܡܘܬܐ ܣܪܘܐ ܢܕܠܐ ܟܐܡܐ ܡܠܘܠܘܬܐ ܘܢܐ ܠܘܒܐ ܐܝܡ ܕܟܒܪܐ ܗܣܘܗ
ܢܘܡܘܬܐ ܕܗܠܢܬܐ ܣܒ ܪܝܐ (ܥܒܘܡ ܠܟܘܪܢܐ ܕܦܘܣܐ). ܦ : ٢ ܡ ܪܒ

ܬ١٠ : ܢܦܠܠܗ ܠܘܬܡܐ ܒܘܕܠܗ (٥ ܠܝܛ) ܡܢ ܬܠܘܬܐ ܐܬܒܫ ܕܘܡܦܘ ܘܡܚܐ ܐܝܡܢ ܕܡܚܝܕ (١٠ ܣ) ܘܒܘܝܠܐ ܕܫܠܐ ܕܡܒܟܒ ܟܠܗ ܕܡܒܠܐܠܗ ܒܐܕ ܕܡܚܝܕ ܡܘܫܚܘܬܐ ٥٠ ܣܡ ܡܢ ܕܦܩܐ ܕܡܒܟܒܢܘܬܐ ܕܫܠܐ.

ܦ : ٥٠٠ ܓܘܠ. ١٠٥ ܫܢܝ̈

ܬ١١ : ܦܒܢܠܗ ܕܦܩܐ ܓܘܠܐ ܒܘܕܠܗ (٣٥ ܓܡ) ܟܠ ܢܝܫܐ ܗܡܝܕܐ ܘܡܒܕܠܗ ܒܗ ܒܡܠܘܠܘܬܐ (٤٠٠ ܡ ܕܩ) ܒܝܘܒܐ ܐܘܦܡܐ ܘܦܠܓܠܗ ܡܢܗ ܐܘܦܡܐ ܒܡܠܘܠܘܬܐ ٣٠٠ ܡ ܕܩ ܐ. ܚܠܡܘܬܐ ܕܢܝܫܐ (٥ܣܡ) ܐܬܒܫ ܡܢܝܚܐ ܕܒܘܪܐ ܕܢܝܫܐ؟ ܘܐ. ܬܘܫܠܦܠܗ ܟܠܗ ܕܘܡܦܘ ܓܠܝܡܐ ܠܗ ܢܝܫܐ ܠܚܡܝܡܘܬܐ ܟܡܐ ܝܠܗ ܟܡܝܘܬܐ ܕܐܘܐ ܚܡܝܡܘܬܐ؟

ܦ : ٢٤٥٠٠ ܫܢܝ̈. ١٢٢٥ ܓܘܠ

ܬ١٢ : ܬܘܫܠܦܠܗ ܡܠܘܠܘܬܐ ܕܕܒܝܬܐ ܒܘܕܠܗ ٢ ܓܒܐ ܡܢ (٩٠ ܣܡ ܬܟ) ܠ (٣٦ ܣܡ ܬܟ) ܒܟܠܐܬܐ ܕܡܦܠܚܬܐ ܕܡܒܠܢܐ. ܘܐ. ܬܘܫܠܦܠܗ ܟܠܗ ܕܘܡܦܐ ܓܠܝܡܐ ܠܚܡܝܡܘܬܐ. ܟܡܐ ܝܠܗ ܟܡܝܘܬܐ ܕܚܡܝܡܘܬܐ ܝܠܝܕܬܐ؟

ܦ : ٥٢٥٠٠٠ ܓܘܠ

ܬ١٣ : ܠܘܬܡܐ ܢܘܡܕܪܗ (٢٠ ܫܢܝ̈) ܡܘܕܒܐ ܟܠ ܝܓܠܫܐ ܐܘܦܡܐ ܘܕܒܝܬܐ ܒܗܘܦܐ ܕܕܦܩܐ ܢܦܕܐ ܠܗ ܗܡܝܕܐ ܕܫܠܐ (٢ × ١٠^{٢} ܫܢܝ̈ ܡܕܕܐ) ܘܦܒܢܠܗ ܡܗܘܕܕܐ ܗܘܦܐ ܐܣܕܢܐ ܕܕܦܩܐ ܒܠܘܕܐ ܘܡܦܐ ܘܦܒܢܠܗ ܒܒܝܬܐ ܕܦܩܐ ܡܘܫܚܘܬܐ ܒܘܕܠܗ (٢٠٠ ܡܕܕܐ). ܟܡܐ ܐܘܠܘܬܐ ܗܡܝܕܐ ܕܡܢܐܠܗ ܠܘܬܡܐ ܠܗ ܡܕܫܒܬܐ ܕܫܠܐ ܓܒܢܐ ܡܢܗ؟

ܦ : ٢ ܡ/ܕܩ

ܦܘܫܩܐ ܫܬܝܬܝܐ : ܟܗܪܒܘܬܐ ܫܠܝܬܐ

Static Electricity

ܝܕܥ ܬܠܡܝܕܐ ܒܗܢܐ ܦܘܫܩܐ ܗܘܦܟܐ ܕܟܗܪܒܐ ܘܐܝܬܝܘܬܐ ܕܟܗܪܒܐ ܕܠܘܬܡܐ ܡܡܚܠܢܐ ܘܟܐܘܡܐ ܘܝܕܥ ܚܝܠܐ ܕܒܝܢ ܫܘܢܝܐ ܟܗܪܒܝܐ ܘܚܩܠܐ ܕܐܬܝܠܕ ܐܝܟ ܫܘܢܝܐ ܘܟܠܗܐ ܕܟܘܪܗ ، ܐܦ ܢܝܕܥ ܬܠܡܝܕܐ ܠܗܘܦܟܐ ܕܟܘܫܝܢܐ ܘܦܘܪܫܢܐ ܕܟܘܫܝܢܐ ܟܗܪܒܝܐ ܘܐܫܘܕܥܗ ܒܟܘܪܐ ܕܚܩܠܐ ܟܗܪܒܝܐ، ܘܢܝܕܥ ܥܠ ܗܘܦܟܐ ܕܦܩܘܬܐ ܟܗܪܒܝܬܐ ܘܡܦܩܢܐ ܘܐܘܪܚܐ ܕܐܫܬܡܫܗ

٦ ـ ١ ܟܘܬܪܐ ܥܠ ܟܗܪܒܐ

٦ ـ ٢ ܗܘܠܐ ܡܡܚܠܢܐ ܘܕܡܘܬ
ܡܡܚܠܢܐ ܘܟܐܘܡܐ

٦ ـ ٣ ܚܕܝܘܬܐ ܕܫܘܢܝܐ (ܟܘܠܘܡ)

٦ ـ ٤ ܩܢܘܢ ܟܘܠܘܡ

٦ ـ ٥ ܦܠܓܘܬܐ ܕܫܘܢܝܐ ܟܗܪܒܝܐ
ܥܠ ܓܫܡܐ ܕܠܘܬܡܐ ܟܐܘܡܐ

٦ ـ ٦ ܚܝܠܘܬܐ ܓܫܡܢܝܬܐ
ܫܘܢܝܐ ܟܗܪܒܝܐ

٦ ـ ٧ ܟܗܪܒܘܬܐ ܐܐܪܝܬܐ

٦ ـ ٨ ܚܩܠܐ ܟܗܪܒܝܐ

٦ ـ ٩ ܟܘܪܐ ܕܚܩܠܐ ܟܗܪܒܝܐ ܒܨܘܪܬܐ

٦ ـ ١٠ ܚܩܠܐ ܟܗܪܒܝܐ ܡܫܚܠܦܐ ܘܠܐ ܡܫܚܠܦܐ

٦ ـ ١١ ܫܘܟܢܐ ܕܟܘܪܐ ܕܚܩܠܐ ܟܗܪܒܝܐ ܒܨܘܪܬܐ ܠܒܪ ܓܫܡܐ
ܕܠܘܬܡܐ ܟܐܘܡܐ ܘܟܫܝܪܬܐ.

٦ ـ ١٢ ܟܘܫܝܢܐ ܟܗܪܒܝܐ

٦ ـ ١٣ ܦܘܪܫܢܐ ܕܟܘܫܝܢܐ ܟܗܪܒܝܐ

٦ ـ ١٤ ܐܫܘܕܥܐ ܒܝܢ ܟܘܪܐ ܕܚܩܠܐ ܘܙܠܓܐ ܕܟܘܫܝܢܐ

٦ ـ ١٥ ܓܫܡܐ ܕܟܘܝܘܬ ܟܘܫܝܢܐ

٦ ـ ١٦ ܦܩܘܬܐ ܟܗܪܒܝܬܐ

٦ ـ ١٧ ܡܦܩܢܐ ܟܗܪܒܝܐ

٦ ـ ١٨ ܚܒܘܪܐ ܡܟܒܪܢܐ ܒܦܩܘܬܐ ܕܡܦܩܢܐ

٦ ـ ١٩ ܐܕܫܐ ܕܡܦܩܢܐ

٦ ـ ٢٠ ܐܘܪܚܐ ܕܐܫܬܡܫܐ ܕܡܦܩܢܐ

(٦ - ١) ܡܫܘܚܬܐ ܥܠ ܕܘܪܒܐ

ܡܕܪܢܐ ܟܕ ܗܘ ܕܪܫܐ ܡܩܪܒܬܐ ܕܚܝܠܘܬܐ ܕܘܪܫܐ ܒܬܪܝ ܐܬܪ̈ܘܬܐ ܕܠܝܗ:

ܐ. ܚܝܠܘܬܐ ܓܠܝܙܝܬܐ ܘܡܩܪܒܬܐ ܝܠܗ ܡܢܝܢܐ ܥܠܗ ܗܘܟܡܬܢܝܬܐ ܓܘ ܒܝܬ ܬܘܟܬܐ ܥܠ ܟܠ ܕܐܝܬܘܬܐ ܦܪܝܫܐ ܒܦܪܘܬܐ.

ܒ. ܚܝܠܘܬܐ ܗܘܟܡܬܐ ܘܡܩܪܒܬܐ ܝܠܗ ܡܢܝܢܐ ܥܠ ܕܐܝܠܗ ܚܝܠܘܬܐ ܓܘ ܒܝܬ ܬܘܟܬܐ ܥܠ ܟܠ ܓܘ ܓܝܒܢܐ ܦܪܝܫܐ ܒܙܒܢܐ.

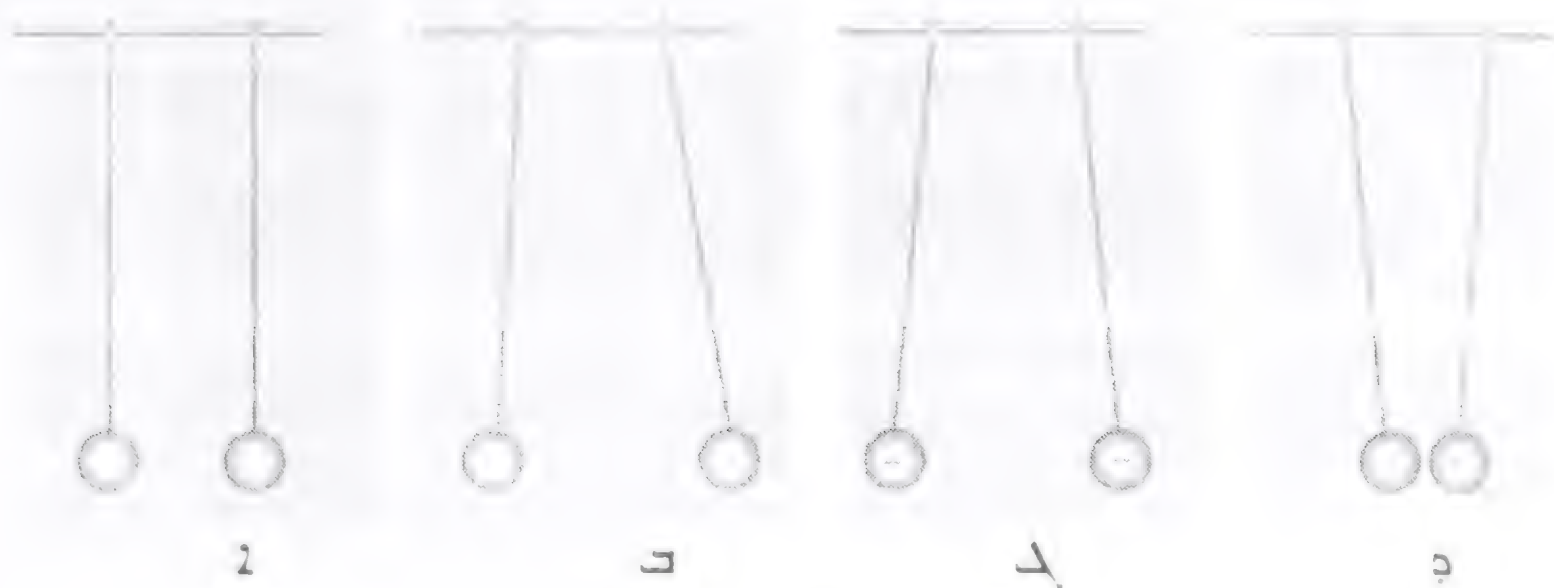
ܗܘܟܡܬܢܝܬܐ ܕܒܘܪܒܬܐ ܐܝܠܐ. ܗܘܝܐ ܒܟܪܒܬܐ ܐܘ ܒܟܠ ܐܢܫܐ ܐܚܪܬܐ ܝܠܗ ܗܘܟܡܬܢܝܬܐ ܕܦܠܓܬܐ ܕܚܝܠܘܬܐ ܒܘܪܒܐ ܥܠ ܓܘܫܡܐ ܦܠܓܐ ܕܠܐ ܒܡܘܬܐ ܕܚܝܠܘܬܐ ܓܠܝܙܐ ܘܗܘܟܡܐ ܥܠ ܓܘܫܡܐ ܘܐ. ܐܢܐ ܚܝܠܘܬܐ ܗܘܝ ܥܠ ܟܝܢܐ ܕܓܘܫܡܐ ܒܡܫܐ ܐܘ ܓܘܫܡܐ ܡܣܓܝܐܐ ܒܡܫܐ ܦܬܝܐ ܐܚܪܬܐ ܕܠܝܗ ܝܠܝܐ ܒܗܝ ܦܠܓܐ ܕܚܠܐ ܒܘܪܒܐ ܡܟܒܪܢܐ ܥܠܝܗ ܬܘܐ ܗܦܟܐ.

ܒܗܕ ܕܐܝܬ ܒܟܪܝܚ ܐܝܬ ܦܫܘܛܐ ܠܕܪܓܐ ܕܕܠܝܬܐ ܕܚܝܠܘܬܐ ܝܠܝܐ. ܘܒܘܪܒܘܬܐ ܝܠܝܬܐ (ܗܠܩܛܪܝܬܐ (Electrostatic ܝܠܗ ܒܘܪܒܘܬܐ ܝܠܝܬܐ ܒܐܘܦܝܐ ܕܚܝܠܘܬܐ ܒܘܝܗ ܢܘܠܐ؛ ܘܚܝܠܘܬܐ ܕܝܠܗ ܡܢ ܚܕ ܐܕܪܐ ܗܘܐ ܒܢܬܗ ܚܝܠܐ ܕܢܦܕܬܐ ܘܐܢܝ ܡܢ ܗܕܝ ܐܕܪܐ ܦܕܪܐ ܗܘܐ ܒܢܬܗ ܚܝܠܐ ܕܢܦܩܐ ܘܦܬܐ ܝܠܗ ܚܝܬܐ ܕܚܝܠܐ ܕܢܦܩܐ ܐܘ ܢܦܕܬܐ ܒܘܪܒܬܐ ܒܝܢ ܗܕܝ ܓܘܫܡܐ ܒܚܝܢܐ ܒܝܕ ܪܒܐ ܝܠܗ ܒܪܒܐ ܡܢ ܚܝܠܐ ܕܢܦܩܐ ܢܦܕܬܐ ܒܢܬܗ (Gravitational Force) ܐܝܟ ܒܝܕ ܚܘܝܐ ܠܗܘܐ ܒܕܝܠܝܬܐ ܘܡܩܪܒܬܐ ܝܠܗ ܚܘܝܬܐ ܕܐܗܘܐ ܡܢ ܢܩܝܒܐ ܕܐܬܝ:

ܐ) ܐ. ܡܠܐܠܝ ܗܕܝ ܠܘܒܬܐ ܡܫܠܐ ܒܘܪܒܐܝܬ ܒܗܕܝ ܓܒܐ ܡܢ ܝܠܕܐ ܠܐ ܡܚܝܬ ܕܚܝܬ ܚܝܠܐ ܕܢܦܩܐ ܢܦܕܬܐ ܒܢܬܗ ܐܝܟ ܡܘܚܘܝܐ ܒܐܗܡܡܐ ٦ -

ܐ) ١ ܠܐܡܬܪܘܬܗ.

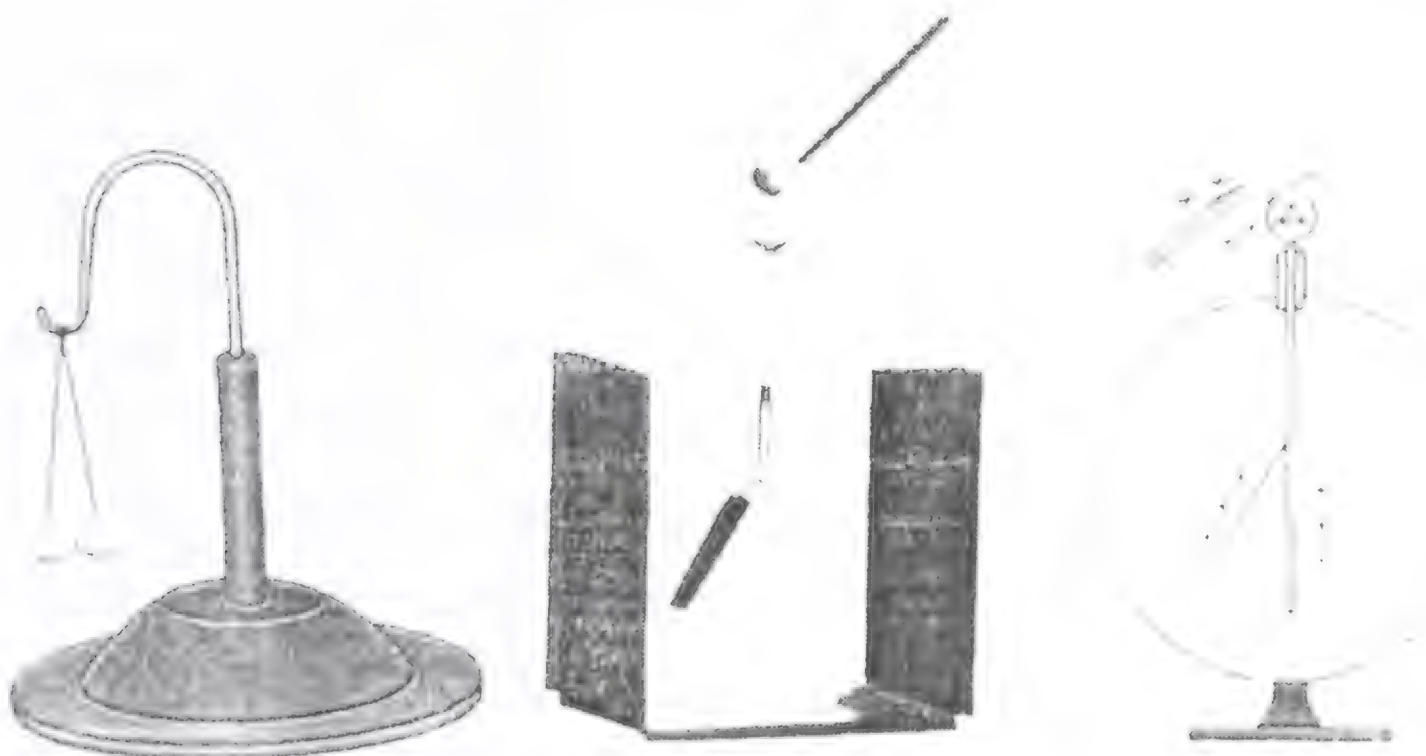
ܒ) ܐ. ܡܘܒܚܝܠܐ ܗܕܝ ܠܘܒܬܐ ܒܗܕܝ ܚܝܠܘܬܐ ܦܕܝܐ ܐܘ ܒܘܪܚܐ ܒܚܘܝܚ ܚܝܠܐ ܕܢܦܩܐ ܐܘ ܢܦܕܬܐ ܒܘܪܒܬܐ ܒܐܗܡܡܐ ܓܠܝܐ ܪܒܐ. (ܐܗܡܡܐ ٦ - ١ ܐ . ܒ . ܓ . ܕ).



ܐܣܟܡܐ (٦ — ١)

ܘܡܪܐܠܘܦ ܒܡܓܥܬܐ ܕܒܪܢܬܐ ܡܩܪܒܝܢ ܠܓܠܠܐ ܡܥܘܢܐ ܚܕܟܡܐ ܐܣܟܡܗ ܘܐܒܝܗ ܦܬܝܠܐ ܒܐܣܟܡܐ (٦ ـ ١ ܗ).

ܘܐܦ ܒܟܪܠܘ ܟܠܗܘܢ ܡܬܚܙܝܐ ܠܗ ܡܦܠܚܬܐ ܕܓܠܠܐ ܒܘܪܟܐ ܠܡܢܝܢܐ ܕܐܬܝ :



ܐܣܟܡܐ (٦ — ١ܗ) : ܐܪܒܥ ܡܢ ܓܠܘܠܐ ܕܘܪܟܐ ܦܬܝܠܐ

ܐ - ܓܠܘܬܐ ܥܠ ܗܘܐܬܐ ܕܚܘܒܬܐ.

ܒ - ܓܠܘܬܐ ܥܠ ܐܪܒܥ ܕܚܘܒܬܐ.

ܓ - ܦܘܫܐ ܒܡ ܚܙܘܬܐ ܕܚܘܒܬܐ ܥܠ ܦܬܝܐ ܕܒܠܚܘܕ ܕܓܘܫܡܐ ܒܚܝܠܐ ܒܡܦܠܚܬܐ ܕܓܘܡܐ ܕܢܘܗܪܐ. ܘܓܘ ܓܝܫܬܐ ܕܓܘܡܐ ܕܢܘܗܪܐ ܠܢܘܗܪܬܐ ܓܘ ܓܘܫܡܐ ܒܚܝܠܐ ܒܡ ܓܝܫܘ ܠܡܕܪܐ ܕܓܠܘܠܐ ܗܘܦܟܐ ܒܘܪܟܢܐ ܒܚܘܝܚ ܒܡܬܠܐ ܕܚܘܬܐ ܕܟܕܘܗܝ ܘܕܡܐ ܒ ܡܫܩܘܠ ܠܓܠܘܠܐ ܘܓܘܡܐ ܕܢܘܗܪܐ ܡܢ ܚܘܒܬܐ ܘܟܢܝܬܐ ܕܗܘܟܕܢܘܬܐ ܠܩܘܒ ܢܘܗܪܬܐ ܐܚܪܢܬܐ ܡܢ ܓܘܫܡܐ ܒܐܝܟܐ ܡܢ

ܒܪܘܚ ܐܝܟܢܘܬܐ ܗܘܐ ܟܘܠܐ ܕܪܩܝܥܐ ܒܝܬ ܬܪ̈ܝܢ ܟܘܟܒ̈ܐ ܣܝܪܬܐ ܕܟܘܟܒܬܐ
ܟܘܪ̈ܟܐ ܬܪ̈ܝܢ ܐܝܟ ܢܘܩܙܐ ܡܢ ܦܢܝܬܐ ܕܦܫܝܛܐ ܟܣܢܐ ܒܝܬ ܬܪ̈ܝܢ.

ܕ. ܠܦܘܣܛܐ ܚܕ ܗܘܝܢ ܟܘܪ̈ܟܐ ܠܢܘܩܙܐ ܕܒܦܢܝܬܐ ܕܦܫܝܛܐ ܡܬܚܝܢܐ ܟܣܢܐ. ܘܗܘܐ ܐܝܟ ܟܡܦܠܣܬܐ ܕܟܘܢܐ ܕܟܘܦܢܐ (Proof Plane) ܕܡܩܝܡܐ ܒܗܝ ܐܝܟ ܠܡܕܪ̈ܟ ܕܐܠܠܦܢܐ ܒܕ ܐܝܬ ܒܗ ܦܫܝܛܐ ܟܣܢܐ ܐܠܦܬܐ ܚܠܦܐ ܕܒܝܬܘ ܕܐܠܐ ܡܕܡܟܐ ܕܟܘܢܐ ܕܟܘܦܢܐ ܡܢ ܦܫܝܛܐ ܘܗܘܠܐ ܕܪܩܝܥܐ ܕܟܕܘܢܝܗ ܘܕܡܐ ܕܐܠܠܦܢܐ ܐܠܘ ܚܠܐ ܠܟܘܟܒ̈ܐ ܕܦܫܝܛܐ ܟܣܢܐ ܘܗܘܐ ܒܘܢܐ ܒܟܠܗܝ ܢܘܩܙܐ ܕܒܦܢܝܬܐ ܕܦܫܝܛܐ ܟܣܢܐ ܒܟܘܟܒܬܐ ܟܠܗܝܐ.

(٦ ٢) ܗܘܠܐ ܡܡܛܝܢܐ ܘܕܡܘܬ ܡܡܛܝܢܐ ܘܟܐܘܦܢܐ

١) **ܗܘܠܐ ܡܡܛܝܢܐ** ܐܠܘ ܗܘܠܐ ܕܐܝܬ ܥܠ ܦܪܘܬܐ ܒܟܘܟܒܬܐ ܣܝܪܬܐ ܘܗܘܝ ܟܘܟܒܬܐ ܐܠܘܦ ܐܘ ܦܫܘܛܐ ܐܘ ܐܝܟܢܐ ܘܒܪܒܝ ܒܒܪܝܬܐ ܕܠܦܐ ܟܘܪ̈ܟܐ ܐܝܟ ܣܦܪܐ ܘܒܪܝܐ ܕܡܥܘܙܐ ܘܒܢܐ ܘܥܠܡܐ (ܐܠܟܬܪܘܠܝܬܐ).

٢) **ܗܘܠܐ ܕܡܘܬ ܡܡܛܝܢܐ** ܠܐ ܐܠܘ ܗܘܠܐ ܦܬܝܐ ܕܡܡܛܝܬܐ ܘܠܐ ܟܗܘܦܢܐ ܦܬܝܐ ܒܕܪܠܐ ܚܕܝܐ ܕܡܥܡܥܘܬܐ ܐܠܐ ܐܠܘ ܟܗܘܦܢܐ ܦܬܝܐ ܒܕܪܠܐ ܟܘܦܐ ܕܡܥܡܥܘܬܐ ܘܡܡܛܝܢܐ ܦܬܝܐ ܒܕܪܠܐ ܥܠܝܐ ܕܡܥܡܥܘܬܐ ܐܝܟ ܦܠܝܚܘ. ܘܦܪܦܫܘܬ ܕܦܝܢ ܡܘܦܠܣܐ ܪ̈ܒܐ ܒܗ ܗܘܝܢ ܐܠܟܬܪܘܢܝܐ.

٣) **ܗܘܠܐ ܟܗܘܦܢܐ** ܐܠܘ ܗܘܠܐ ܕܐܝܬ ܥܠܝܠ ܡܢ ܟܘܟܒܬܐ ܣܝܪܬܐ ܘܠܐ ܒܪܡ ܒܒܪܝܬܐ ܕܠܦܐ ܟܘܪ̈ܟܐ ܐܝܟ ܡܛܠܝܐ ܦܫܝܛܐ ܘܐܦܘܠܝܬܐ ܘܡܕܝܢܐ ܘܩܠܕܐ ܘܦܘܫܐ ܒܪܝܬܐ ܘܡܛܐ ܢܝܠܐ .. ܘܒܪܝܬܐ ܘܐܦܠܝܬܐ ܕܐܡܦܪܐ ܕܗܘܠܐ ܕܒܝܬܐ ܒܟܝܢܘܬܐ ܕܢܛܪܐ ܘܠܐ ܪܦܘܬܐ ܕܢܛܪܐ ܪܒܝܬ ܡܢ ܢܘܬܐ ܦܫܘܛܐ ܕܟܘܟܒܬܐ ܦܪܬܠ ܣܪ̈ܪܐ ܒܗ ܟܪܘܒܝܐ ܐܠܟܬܪܘܢܐ ܐܠܘܦ ܕܟܘܟܒܬܐ ܘܢܛܪܐ ܗܘܠܐ ܟܘܪ̈ܟܢܐ ܐܠܘ ܢܛܪܐ ܕܗܘܐ ܟܘܢܝܐ ܕܟܘܟܒܬܐ ܠܐ ܐܠܟܬܪܘܢܘ ܒܘܢ ܚܠܝܢܐ ܠܟܘܢܝܐ ܕܟܘܟܒܬܐ ܕܢܘܬܐ ܘܦܝܢܐ ܟܘܟܒܬܐ ܚܠܝܢܬܐ ܕܢܛܪܐ ܦܩܝܡܐ ܘܐܡܪܝ ܐܢܐ ܐܠܟܬܪܘܢܐ ܒܢܘܬܐ ܒܟܠܬܐ ܕܢܬܦܬܐ ܟܘܪ̈ܟܬܐ ܒܢܬܐܝܘ ܘܒܝܬ ܢܘܬܐ ܘܡܣܡܬܐ ܐܠܘ ܠܒܪܬܐ ܕܐܢܐ ܐܠܟܬܪܘܢܐ ܦܪܬܠ ܣܪܕ ܢܘܬܐ ܒܗ ܪܘܚܐ ܕܡܘܠܐ ܡܟܣܝܐ ܡܬܚܪܘܪܝܗ ܒܗ ܢܘܬܐ ܘܠܐ ܐܠܘ ܡܡܝܬܐ ܕܗܘܝ ܐܠܟܬܪܘܢܐ ܒܝܬ ܟܪܝ ܡܘܠܐ ܡܢ ܐܢܐ ܡܘܠܐ ܘܢܛܪܐ ܡܕ ܐܝܢܬܐ ܚܢܝܢܬܐ ܡܢ ܕܒܪܡ ܟܪܘܒܝܗ ܒܪ̈ܐ ܡܒܛܠܐ ܒܐܠܟܬܪܘܢܐ ܡܢ ܕܦܬܝܐ ܒܐܢܒܝܢܘܬܐ ܕܥܠܘܬܐ ܘܡܡܛܝܬܐ ܐܠܘ ܠܒܪܬܐ ܕܐܠܦܐ ܐܠܟܬܪܘ. ܐܘ ܢܛܪܐ. ܡܢܐܠܘ ܗܘܦܐ ܡܠܝܢܐ

ܠܐܘ ܡܢ ܕܚܕܐ ܡܢܗܘܢ ܗܢܐ ܐܠܩܛܪܘܢܐ ܐܘ ܢܦܩ ܠܘܩܒܠܐ ܥܠ ܚܝܠܐ ܕܢܓܕܐ ܕܢܘܗܐ ܠܗ ܘܥܒܕܐ ܕܗܘܐ ܐܝܟ ܗܘܦܟܐ ܕܫܝܠܬܗ ܢܛܪܐ ܒܐܬܪܘܬܐ ܕܡܩܡܘܬܐ ܐܘ ܠܫܠܠܐ ܕܡܥܒܪܢܐ ܐܘ ܒܗܘܪܐ ܐܘ ܐ. ܦܫܝܛܐܝܬ ܡܢܝܫܐ ܢܛܪܐ ܒܡܩܡܘܬܐ ܐܬܪܢܝܐ ܐܝܟ ܐܠܩܛܪܘܢܐ ܡܩܕܡܝܐ ܘܗܘܝܐ ܡܫܚܠܦܢܐ ܩܢܘܡ ܠܗܘܢܝܐ ܪܒܐ ܒܚܘܪܐ ܡܢ ܕܡܫܠܡ ܡܢܝܢܐ ܡܢ ܐܠܩܛܪܘܢܘ ܘܗܘܝܐ ܒܗܘܢܐ ܩܢܘܡ ܠܗܘܢܝܐ ܪܒܐ ܠܚܘܪܐ ܡܢ ܕܫܠܡ ܡܢܝܢܐ ܡܢ ܐܠܩܛܪܘܢܘ ܐܠܐ ܗܘܝܐ ܕܗܘܐ ܡܫܚܠܦܢܐ ܒܩܢܘܡ ܠܗܘܢܝܐ ܒܪ ܪܒܐ ܒܡܠܒܠ ܡܢ ܗܘܝܐ ܡܫܚܠܦܢܐ ܕܝܢܐ ܐܠܩܛܪܘܢ ܡܢܗ

ܘܡܢܗܘܢ ܕܗܘܐ ܡܫܚܠܦܢܐ ܒܐܝܘܢܘܬܐ ܘܪܒܬܐ ܒܚܘܠܐ ܝܘܡܢܐ ܒܗܘ ܡܢܗ ܦܪ ܡܬܘܪܐ ܗܪܝܢ ܒܠܘܪܐ ܘܗܪܢܡܬܘܪ ܡܢ ܠܡܩܘܝܬܐ ܗܘܪܪܢܐ ܪܘܚܐ.

(٦ - ٣) ܚܕܝܘܬܐ ܕܛܥܘܢܬܐ (ܟܘܠܘܡ)

ܚܕܝܘܬܐ ܡܬܚܫܒܬܐ ܕܛܥܘܢܬܐ ܒܡܕܝܢܬܐ ܝܠܗ ܟܘܠܘܡ (Coulomb) ܘܒܫܡܗ ܝܢܠ ܘܦܫܪܐ ܒܝܠܕܐ ܒܐܘܪܚܐ ܦܪܝܫܐ ܗܒܠܐ ܥܠ ܡܬܒܪܢܘܬܐ ܡܬܢܛܪܢܐ ܐܘ ܒܡܫܢܝܐ ܕܠܦܐ ܒܗܪܟܐ.

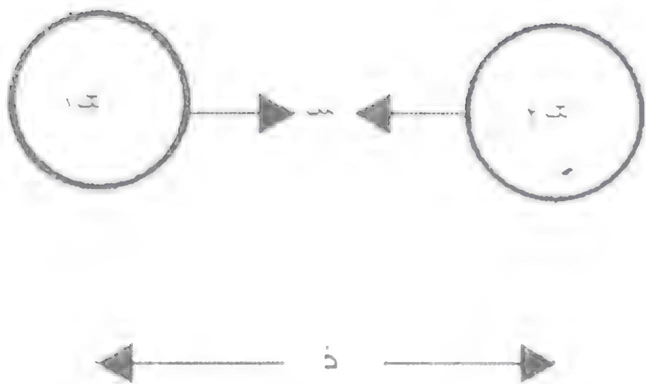
ܘܟܘܠܘܡ ܚܕܝܘܬܐ ܠܒܘܪܬܐ ܝܠܗ ܐ. ܦܫܝܛܐܝܬ ܦܘܫܩܬܐ ܒܛܥܘܢܬܐ ܕܐܠܩܛܪܘܢ ܐܘ ܦܪܘܛܘܢ ܘܛܥܘܢܬܐ ܕܐܠܩܛܪܘܢ ܡܢ ܠܘܦܩܐ ܒܡܢܐ ܡܗܪܢܝܐ $(١٫٦ \times ١٠^{-١٩})$ ܟܘܠܘܡ ܘܦܫܝܛܐܝܬ ܚܝܠܐ ܒܝܫܢܐ ܗܘܪܪܢܐ ܐ. ܕܝܬܒ ܟܘܠܐ ܕܛܥܘܢܬܐ ܒܠܝܬܐ ܝܠܗ $(١٫٦ \times ١٠^{-١٩})$ ܟܘܠܘܡ ܐܝܟ ܕܝܠܗ ܐܝܢܘܬܐ ܒܝܫܢܐ ܕܡܬܝܒܐ ܠܟܠܝܐ ܕܛܥܘܢܬܐ ܕܐܠܩܛܪܘܢ. ܒܗܕ ܕܐܗܐ ܦܫܝܛܐ ܗܢܝܠܬܐ ܛܥܘܢܬܐ $(١٫٦ \times ١٠^{-١٩})$ ܟܘܠܘܡ ܟܡܘܢܐ ܠܛܥܘܢܬܐ ܕܐܠܩܛܪܘܢ. ܒܠܝܐ ܘܝܠܗ ܝܬܒܪ ܛܥܘܢܬܐ ܡܢܝܢܬܐ ܡܢܝܬܐ ܥܠܠܗ ܒܗ ܒܢܝܐ ܗܠ ܗܕܝܐ ܐܦ ܦܪܬܐ ܕܡܫܘܚܘܬܐ ܗܐܦܪܝܫܐ ܥܠ ܗܘܝܐ ܕܡܢܝܐ ܡܢ ܕܐܗܐ ܛܥܘܢܬܐ ܦܠܝܓܬܐ ܡܢ ܦܠܓܬܐ ܕܦܪܘܬܐ. ܕܐܝܬ ܒܗ ܢܘܬܐ ܦܪܬܐ ܡܪܝܬܐ ܒܗܪܟ (Quark) ܘܝܠܗ ܐܫܪܪܐ ܒܚܝܠܐ ܪܒܐ ܐܠܐ ܠܐ ܡܘܢܬܐܠܗ ܢܫܝܢܐ ܗܠ ܗܕܝܐ ܒܢܒܪܬܐ ܕܐܗܐ.

ܘܥܠ ܕܐܗܐ ܐܦܐ ܡܢܝܢܐ ܕܐܠܩܛܪܘܢܐ ܕܟܠܐ ܦܪܬܗܘܢ ܒܗ ܒܟܘܡܐ ܕܗܘܝܐ

$$ܛܥܘܢܬܗ\ ܕܚܕ\ ܟܘܠܘܡ = \frac{١\ ܟܘܠܘܡ}{١٫٦ \times ١٠^{-١٩}\ \frac{ܟܘܠܘܡ}{ܐܠܩܛܪܘܢ}} = ٦٫٢٥ \times ١٠^{١٨}\ ܐܠܩܛܪܘܢ.$$

ܟܘܕ ܕܗܘܐ ܚܕ ܟܘܠܘܡ (ܟܠ) ܗܘܐ ܫܘܝܐ ٦٫٢٥ × ١٠^١٨ ܐܠܩܛܪܘܢܐ ܐܠܐ ܡܢܬܐ ܕܟܘܠܘܡ ܦܪܝܫܐ ܕܡܦܠܚܬܐ ܝܠܗ̇ ܡܠܝ ܟܘܠܘܡ (ܡܠܟܠ) = ١٠^-٣ ܟܘܠܘܡ. ܡܝܩܪܘܟܘܠܘܡ (ܡܟܠ) = ١٠^-٦ ܟܘܠܘܡ. ܒܝܩܘܟܘܠܘܡ (ܒܟܠ) = ١٠^-١٢ ܟܘܠܘܡ.

(٦ - ٤) ܢܡܘܣܝ ܟܘܠܘܡ Coulomb's Law



ܨܘܪܬܐ (٦ - ٢)

ܡܫܟܚܠܗ ܝܕܘܥܐ ܟܘܠܘܡ (١٨٧٥ ܡ) ܢܡܘܣܐ ܝܕܝܥܐ ܡܕܡܝܐ ܠܗ ܒܫܡܗ ܥܠ ܐܬܪܐ ܕܦܘܠܚܢܐ ܡܢܐ ܒܝܢ ܩܘܝܬܐ ܚܝܠܐ ܒܝܢܬܐ ܕܐܝ ܦܟܠܗ ܡܘܬܒܐ ܥܠ ܬܪܝܢ ܩܘܝܬܐ ܐܝܟ ܩ١ ، ܩ٢ ܡܘܬܒܐ ܒܡܪܚܩܐ ܐܘ ܦܣܩܐ ܐܝܟ ܒܨܘܪܬܐ (٦ - ٢) ܘܒܡܪܚܩܐ ܒܝܢܬܝܗܘܢ (ܡ) ܚܙܐ ܡܢܝܗ ܒܡܪܚܩܐ ܥܠ ܐܝܟܢܐ ܕܚܝܠܐ ܕܡܪܟܢܐ (ܚ)، ܒܘܝܠܗ ܦܝܫ ܥܒܝܕܐ ܥܠ ܦܠܓܐ ܕܡܩܦܐ ܒܘܝܠܐ ܕܩܘܝܬܐ ܘܦܬܝܟܐ ܥܡ ܡܪܟܢܐ ܕܡܪܚܩܐ ܒܝܢ ܬܪܬܝܗܝ ܩܘܝܬܐ ܘܥܠ ܕܗܘܐ ܚܝܠܠܗ ܡܢܘܢܐ ܕܐܬܐ:

ܦܝܫ ܚܝܠܐ ܕܡܪܟܢܐ ܡܫܬܠܦܢܐ ܒܝܢ ܬܪܝܢ ܩܘܝܬܐ ܕܡܪܟܢܐ ܡܘܬܒܐ ܠܗ ܫܘܘܝܐ ܬܠܝܬܐ ܥܠ ܦܠܓܐ ܕܡܩܦܐ ܕܬܪܘܝܗܝ ܒܘܝܠܐ ܕܬܪܘܝܗܝ ܩܘܝܬܐ ܘܦܬܝܟܐ ܥܡ ܡܪܟܢܐ ܕܡܪܚܩܐ ܒܝܢܬܝܗܝ:

ܘܡܦܝܫܬܐ ܝܠܗ̇ ܕܗܘܐ ܡܢܘܢܐ ܡܬܠܬܐ ܡܫܘܬܦܬܐ ܕܐܬܐ:

$$ܚ \propto \frac{ܩ_1\,ܩ_2}{ܡ^2} \qquad ܚ = \text{ܩܝܡܬܐ}\,\frac{ܩ_1\,ܩ_2}{ܡ^2} \quad \ldots\ldots (٦ — ١)$$

ܘܡܬܚܫܒ ܠܬܪܘܝܗܝ ܩܘܝܬܐ ܡܘܬܒܐ ܠܢܩܕܐ ܡܬܠܦܢܐ ܐܝ ܗܘܝ ܥܠ ܬܪܝ ܠܘܬܐ ܒܚܕܐ ܦܠܓܐ ܕܡܬܪܚܩܝ ܪܒܐ ܡܢܗܘܢ ܠܩܘܐ ܠܒܘܪܟܐ ܒܝܢ ܡܬܪܚܩܝ. ܐܠܐ ܒܘܝܠܐ ܩܝܡܬܐ ܕܦܫܘܛܐ ܠܗ ܡܢܘ. ܟܘܠܘܡ ܟܠܐ ܥܠ ܬܚܬܐ ܕܫܪܝܬܐ ܡܘܦܠܐ ܒܝܢܘ. ܘܥܠ ܐܪܒܐ ܕܡܦܝܫܐ ܕܦܪܫ ܒܝܢ ܩܘܝܬܐ.

ܘܦܝܫܐ ܣܝܡܬܐ ܕܐ. ܗܘ ܒܫܘܢܝܬܐ (ܒ١. ܒ٢) ܥܠܬ ܒܪܘܚܩܗ ܘܒܡܪܒܥܐ (ܟ)
ܥܠܬ ܒܡܫܚܬܐ ܘܚܝܠܐ (ܚ) ܒܢܘܛܢ. ܘܡܝܬܝܐ ܦܪܫܐ ܒܝܢ ܐܪܒܥ ܒܫܘܢܝܬܐ
ܐܠܐ ܦܘܫܐ ܐܘ ܡܦܘܩܢܐ ܘܡܬܝܚܐ ܕܡܫܘܚܬܐ ܒܡܢܘ. ܒܗܠܝܢ ܟܘܪ.

$$\frac{\text{ܢܘܛܢ . ܡܝܬܪ}^{2}}{\text{كولوم}^{2}} \; 9 \times 10^{9}$$

ܐܢܫܬܐ ܐܠܐ ܣܝܡܬܐ ܕܡܢܘ. ܒܗܠܝܢ ܦܪ ܡܘܦܠܫܐ ܥܠ ܒܫܘܢܝܬܐ
ܢܡܘܬܢܝܐ ܐܘ ܠܡܬܡܢܐ ܠܡܘܬܢܝܐ ܒܫܢܐ ܕܡܘܝܬܐ ܐܠܐ ܗܫܟܚܐ ܕܡܬܚܙܐ.
ܕܒܫܘܢܝܬܐ ܠܗܝܢ ܐܠܐ ܒܪܬܪܬܐ ܠܡܢܘܬܐ ܡܬܡܘܡܝܬܐ. ܐܝܟ ܠܗܘܐ ܘܕܐܠܐ
ܒܫܢܐ ܘܠܡܬܡܢܐ ܠܐ ܠܡܘܬܢܝܐ ܒܫܢܐ ܐܘ ܠܡܘܬܢܝܐ ܡܬܝܒܐ ܘܦܝܫܐ ܒܡܪܪܐ
ܡܢܘ. ܒܗܠܝܢ ܠܡܬܚܙܐ ܡܬܚܙܝܐ ܡܢ ܒܡܬܪܐ ܘܠܡܫܘܚܬܐ ܕܐܪܐ ܡܢ ܒܫܘܢܝܬܐ
ܐܠܐ ܠܐ ܦܝܫܐ ܒܪܪܬܐ ܗܪܝܘܬܐ ܕܠܡܫܘܚܗ ܥܠ ܒܫܘܢܝܬܐ ܕܐܪܐ
ܘܒܡܬܪܐ ܕܐܪܐ ܥܠ ܚܠܬܐ ܢܗܪܐ ܐܘ ܥܠ ܒܫܘܢܝܬܐ ܡܬܥܠܝܐ ܘܦܪܝܫܬܐ
ܕܡܪܟܢܐ ܡܠܘܠܘܬܗ ܡܢ ܡܠܘܠܘܬܐ ܕܚܘܪܐ.

ܡܘܦܩܐ (١)

ܗܪܐ ܠܡܘܬܢܝܬܐ ܕܐܪܐ ܒܫܢܐ ܒܗܪܐ ܒܫܘܢܝܬܐ ܚܡܠܐ ܕܒܫܘܢܝܬܐ ܡܬܚܫܒܐ
(+٢) ܡܝܟܪܘܟܘܠܘܡ ܘܚܡܠܐ ܕܒܫܘܢܝܬܐ ܗܪܢܝܬܐ (+٥) ܡܝܟܪܘܟܘܠܘܡ
ܘܐ. ܗܪܘܝܗ ܠܡܘܬܢܝܬܐ ܢܗܘܘ ܡܬܚܙܐ ܠܗ ܦܘܫܐ ܘܒܡܬܪܐ ܒܝܢ ܡܬܦܪܘܫܝܗ
(٩٠) ܣܢܬܝܡܝܬܪܐ ܚܫܒ ܚܝܠܐ ܕܡܪܪܢܐ ܡܬܚܠܦܢܐ ܒܝܢ ܗܪܘܝܗ ܠܡܘܬܢܝܬܐ
ܡܚܘܝܢܐ ܐܪܙܐ ܕܐܗܐ ܚܝܠܐ ܘܕܒܪܐ ܠܟܠܗܐ.

ܫܪܝܐ

ܐܝܟ ܡܚܘܝܢܐ ܒܨܘܪܬܐ (٦ - ٣)

+٢ ܡܝܟ

+٥ ܡܝܟ

ܪ = ٩٠ ܣܡ

ܨܘܪܬܐ (٦ — ٣)

$$ܚ = ܡܠ \frac{ܛ_1 ܛ_2}{ܪ^2}$$

$$ܚ = ٩ \times ١٠^{٩} \frac{(+٢ \times ١٠^{-٦}) \times (+٥ \times ١٠^{-٦})}{(٩٠ \times ١٠^{-٢})^{٢}}$$

$ܚ = \frac{١}{٩}$ ܢܛ ܗܘܝܐ ܕܚܝܠܐ ܡܬܚܠܦܬܐ ܒܝܢ ܬܪܬܝܢ ܠܘܩܒܠ ܐܚܕܐ ܘܚܝܠܐ ܕܕܚܝܬܐ ܒܗܝ ܬܪܬܝܢ ܛܥܘܢܬܐ ܡܢ ܚܕ ܐܚܪܢܐ ܡܠܝܗ.

ܬܘܦܣܐ (٢)

ܦܬܟܝܗ ܡܘܬܒ ܬܠܬܐ ܛܥܘܢܬܐ ܢܩܘܕܐ ܥܠ ܣܪܛܐ ܦܫܝܛܐ ܗܟܢ $ܛ_1 = +٤$ ܡܝܩܪܘܟܘܠܘܡ، $ܛ_2 = -٥$ ܡܝܩܪܘܟܘܠܘܡ، $ܛ_3 = +٦$ ܡܝܩܪܘܟܘܠܘܡ ܠܦܘܬ ܡܫܪܝܘܬܐ ܚܙܝ ܗܘܝܐ ܕܦܘܠܚܢܐ ܕܚܝܠܐ ܡܬܚܕܝܢ ܥܠ ܛܥܘܢܬܐ ܡܨܥܝܬܐ ܐܢ ܗܘܐ ܪܘܚܩܐ ܒܝܢ ܛܥܘܢܬܐ ܩܕܡܝܬܐ ܘܡܨܥܝܬܐ ܗܘ ܡܝܬܪܐ ܘܪܘܚܩܐ ܒܝܢ ܛܥܘܢܬܐ ܡܨܥܝܬܐ ܘܬܠܝܬܝܬܐ (٤) ܡܝܬܪ؟

ܥܢܝܐ

ܐܝܟ ܡܘܚܘܝܢ ܒܐܣܟܡܐ (٦ - ٤) ܦܘܠܚܢܐ ܕܚܝܠܐ ܡܬܚܕܝܢ ܥܠ ܛܥܘܢܬܐ ܡܨܥܝܬܐ $ܚ = ܚ_1 + ܚ_2$

ܐܣܟܡܐ (٦ — ٤)

$$ܚ = ܡܠ \frac{ܛ_1 ܛ_2}{ܪ^2}$$ ܠܦܘܬ ܚܝܠܐ ܩܕܡܝܐ

$$ܚ_1 = ٩ \times ١٠^{٩} \frac{(+٤ \times ١٠^{-٦}) \times (-٥ \times ١٠^{-٦})}{(٢)^{٢}}$$

ܫ١ = −٠.٠٤٥ ܓܠ ܠܓܘܦܐ ܟܡ ܒ١

$$ܫ_{٢} = ٩ \times ١٠^{٩} \times \frac{(-٥ \times ١٠^{-٦}) \times (٦ \times ١٠^{-٦})}{(٤)^{٢}}$$

ܫ٢ = −٠.٠١٦٩ ܓܠ ܠܓܘܦܐ ܟܡ ܒ٢

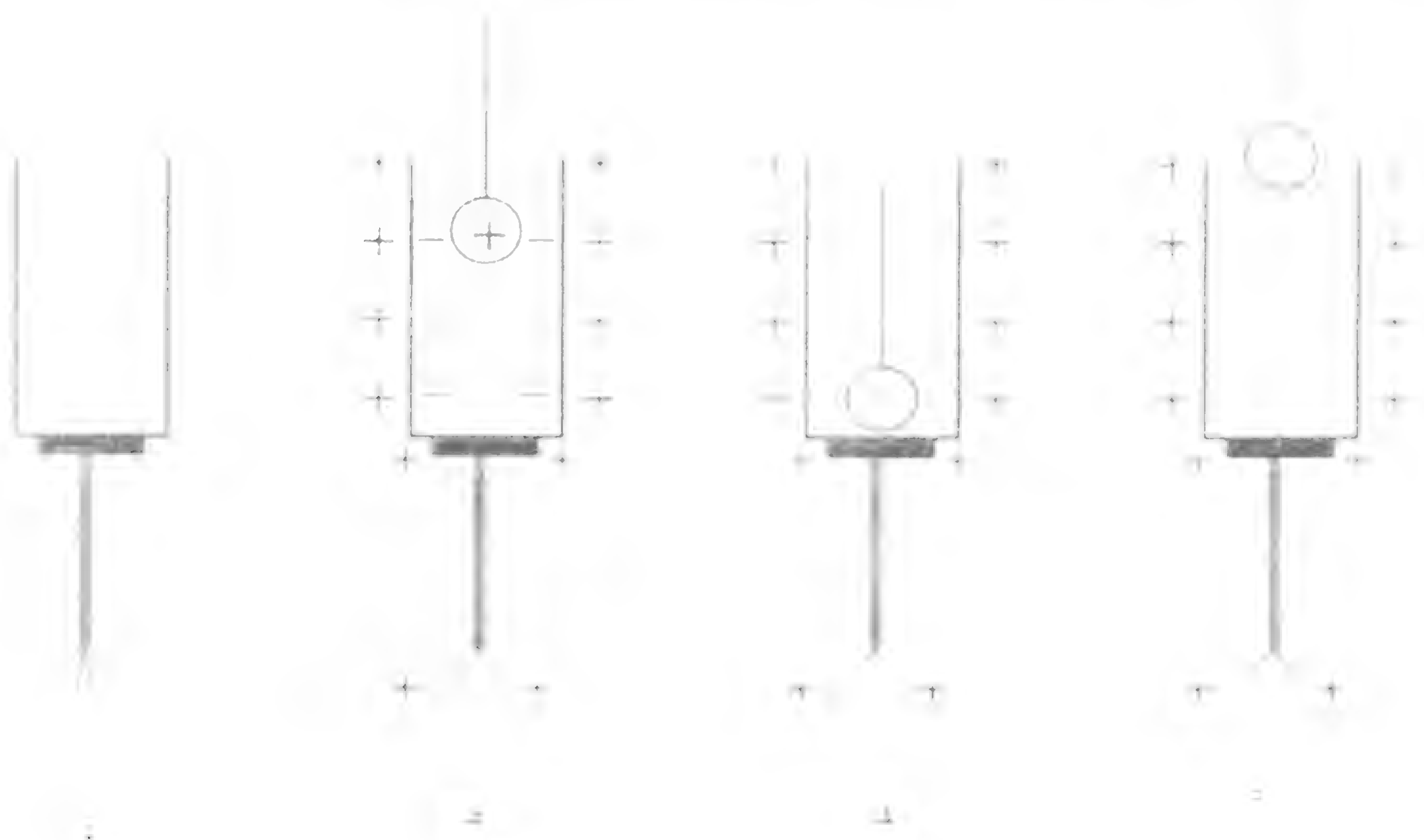
ܦܘܠܚܢܐ ܕܚܝܠܐ ܡܫܟܢܢܐ ܟܣܘܝܬܐ ܟܪܝܬܐ = −٠.٠٤٥ ܓܠ −(−٠.٠١٦٩) ܓܠ

= −٠.٠٤٥ ܓܠ + ٠.٠١٦٩ ܓܠ

= ٠.٠٢٨١ ܓܠ ܘܗܠܝܢ ܚܝܠܐ ܕܠܓܘܦܐ ܟܡ ܟܣܘܝܬܐ ܒ١

(٦ - ٥) ܦܠܛܘܬܐ ܕܟܣܘܝܬܐ ܟܘܪܟܐ ܥܠ ܥܒܘܕܐ ܕܠܘܚܡܐ ܠܐ ܡܫܝܢܐ

ܡܚܘܝܐ ܟܣܘܝܬܐ ܟܠܝܬܐ ܠܟܣܘܝ ܥܠ ܥܒܘܕܐ ܟܪܝܐ ܕܠܘܚܡܐ ܡܫܝܢܐ ܟܣܝܐ ܟܟܠܝܬܐ ܕܢܦܩܬܗ ܠܐ. ܦܬܠܗ ܡܘܟܝܢ ܠܗܝ ܐܠܐ ܥܒܘܕܐ ܟܪܝܐ ܗܘܐ ܠܗܘܠܐ ܟܘܪܟܝܬ ܘܡܘܟܣܠܗ ܡܢܚܠ ܦܪܝܢ ܐܘܐ ܗܘܟܪܝܬ ܟܢܝܚܘ ܡܢܘܬܐ ܟܥܡܐ ܕܝܢܢܐ ܕܦܠܛܐ ܕܦܪܝܢ ܠܠܢܐ ܟܨܘܪܬܐ (٦ - ٥).



ܨܘܪܬܐ (٦ — ٥)

ܘܐܣܟܡܐ (٦ - ٥) ܓܘܝܫ ܡܚܘܝܐ ܕܡܛܝܒܬܐ ܕܢܫܝ̈ܐ ܕܫܘܩܐ ܕܦܪ̈ܕܐ ܕܒܘܪܟܠܗ ܝܘܗ ܕܟܡܘܬܐ ܥܠܬܐ ܣܩܘܒܠ ܒܠܚܘܕ ܥܠ ܓܒܝܢܐ ܒܪ̈ܝܐ ܕܛܘܟܣܐ ܡܛܝ̈ܒܢܐ ܟܡܝܐ ܘܦܪܝܫܐ ܒܗܕ ܕܐܗܐ ܡܟܝܢ ܟܠܗ ܟܡܘܬܐ ܡܢ ܛܘܟܣܐ ܟܡܝܐ ܠܛܘܟܣܐ ܐܚܪܢܐ ܐ. ܛܘܟܣܐ ܟܡܝܐ ܗܘܐ ܠܐܢܐ ܒܓܒܝܢܐ ܛܘܗܝ ܕܛܘܟܣܐ ܐܚܪܢܐ ܐܝܟ ܒܐܣܟܡܐ (٦ - ٥).

(٦ - ٦) ܚܝܠܘܬܐ ܓܡܝܫܬܐ ܕܟܡܘܬܐ ܕܒܘܪܟܬܐ

ܡܘܟܚܠܘ ܢܒܘܪܐ ܝܘܗ ܕܛܘܟܣܐ ܝܘܒܠܢܐ ܟܡܝܐ ܒܗܝܡܐ ܐ. ܦܪܝܫܠܘ ܟܡܝܐ ܒܦܠܓܐ ܟܡܘܬܐ ܥܠ ܓܒܝܢܘ ܒܪ̈ܝܐ ܒܓܒܝܐ ܒܗܕ ܕܐܗܐ ܗܘܐ ܚܝܠܘܬܐ ܕܟܡܘܬܐ ܓܡܝܫܬܐ ܝܘܢܐ ܥܠ ܟܠܗ ܝܘܡܐ ܕܓܒܝܢܐ ܒܒ ܚܝܠܘܬܐ ܕܟܡܘܬܐ ܝܠܗ ܟܡܘܬܐ ܕܐܝܬ ܥܠ ܣܓܝܘܬܐ ܕܓܒܝܘܬܐ ܡܢ ܓܒܝܢܐ ܕܡܛܝ̈ܒܢܐ. ܗܢܐ ܘܒܝܢ:

$$ܚܝܠܘܬܐ\ ܕܟܡܘܬܐ = \frac{ܟܡܘܬܐ\ ܕܐܝܬ\ ܥܠ\ ܓܒܝܢܐ}{ܓܒܝܘܬܐ\ ܓܒܝܢܐ\ ܕܡܛܝ̈ܒܢܐ}$$

$$ܚܓ\ ܟ = \frac{ܟ}{ܓܒ} \qquad \text{(٦ — ٢)}$$

ܐܝܟ ܐ. ܗܘܐ ܗܘܐ ܓܒܝܐ ܐܘ ܢܘܦܠܐ ܐܘ ܒܪܝܐ ܓܒܝܢܐ ܠܓܒܝܢܐ ܡܛܝ̈ܒܢܐ ܟܡܝܐ ܘܒܗܝܡܐ ܟܡܘܬܐ ܒܣܩܘܒܠ ܒܚܝܠܘܬܐ ܒܟ ܒܪܐ ܝܠܗ ܗܘܝܐ ܓܒܝܢܐ ܕܒܒܕܐ.

ܘܐ. ܗܘܐ ܠܓܒܝܢܐ ܕܛܘܟܣܐ ܒܗܝܡܐ ܘܟܡܝܐ ܗܘܝܐ ܓܒܝܢܐ ܐܘ ܚܠܦܢܐ ܕܦܦܬܐ ܚܝܠܘܬܐ ܕܟܡܘܬܐ ܒܐܡܪܐ ܥܠ ܗܘܝܐ ܓܒܝܢܐ ܡܘܠܕܐ ܝܒܝܠܐ ܒܘܪܟܬܐ ܠܒܝܢܐ ܡܢ ܕܟܒܒ ܠܐܢܬܐ ܕܦܘܫ ܒܢܝܫܐ ܒܐܗܐ ܦܦܬܐ ܘܢܬܦ ܒܡܘܫ ܕܦܘܫ ܐܡܘܠܐ ܐܘ ܟܡܝܐ ܒܟܡܘܬܐ ܣܠܝܩܬܐ ܒܓܒܘܠܐ ܙܘܟ ܗܘܝܐ ܓܒܝܢܐ ܒܐܡܠܝ ܒܡ ܡܢ ܟܡܘܬܐ ܕܡܢܝܬܐ ܠܛܘܟܣܐ ܘܢܦܩܝ ܝܘܗ ܘܒܐܗܐ ܗܘܝܐ ܛܘܟܣܐ ܡܢ ܟܡܘܬܗ ܒܘܪܟܬܐ ܒܐܘܪܚܐ ܕܐܗܐ ܗܘܝܐ ܓܒܝܢܐ.

(٦ - ٧) ܕܘܪܟܢܘܬܐ ܐܪܥܝܬܐ

ܒܘܕܪܠܗ ܢܗܝܪܐ ܦܪܝܫܐ ܕܡܫܟܠܗ ܟܝܢܗ ܟܠ ܡܢ ܐܢܫܘܢ. ܒܘܕܠܝܢ ܡܕܟܝܗ ܕܠܐܪ ܝܢܘܐ ܠܒܝܬܐ ܕܘܪܟܢܐ ܝܡܝܢ ܝܘܡ ܐܪܥܐ ܘܡܫܠܦܐ ܠܟܝܢܘܬܐ ܕܐܘܪܐ ܠܒܝܬܐ ܐܝܟ ܕܗܘܐ ܝܗܒ ܕܠܠܢܠܐ ܐܟܕܢܐ.

ܘܠܠܢܠܐ ܐܠܝܬܐ ܡܢ ܛܘܦܣܐ ܗܘܝܐ ܒܣܘܢܕܐ ܕܠܟܝܠ ܕܢܗ ܦܘܠܓܐ ܕܒܣܘܢܕܐ ܘܒܣܘܢܕܐ ܕܠܗܝܢ ܕܢܗ ܡܢܝܢܐ ܠܠܘܝܬܐ ܐܝܟ ܝܠܝܢܐ ܒܨܘܪܬܐ (٦ - ٦).

ܘܦܘܫ ܝܕܥ ܡܕܡܦܣܬܐ ܕܢܝܢܐ ܦܘܠܓܐ ܘܦܠܝܠܝܢܗ ܒܐܪܐ ܕܐܪܥܐ ܐܠܐ ܠܗܝܢ ܕܢܝܢܐ ܠܠܘܝܬܐ ܟܠܗ ܗܘܝܐ ܕܒܣܘܢܕܐ ܡܢܘ ܠܐܪܥܐ ܡܘܟܒܕܐ ܕܟܡܐ ܘܗܢ ܟܠ ܒܪܝܬܐ ܕܒܝܬܐ ܗܘܝܐ ܕܒܢܝܐ ܒܢܝܐ ܟܠ ܒܣܘܢܐ ܕܐܪܥܐ ܐܝܟ ܐܠܝܢܐ ܘܡܕܡܦܣܬܐ ܕܛܘܪܢܐ ܘܒܪܝܐ ܕܦܬܐ ܚܝܬܐ ܦܠܝܛܬܐ ܕܒܝܬܐ ܡܢ ܡܕܡܦܣܬܐ ܕܛܘܪܢܐ ܡܟܪܝܐ ܕܦܣܢܐ ܒܐܪܐ ܠܗܝ ܒܠܠܢܠܐ ܟܪܝܐ ܘܦܬܝܬܐ ܥܠܘ ܚܝܬܐ ܕܒܪܝܬܐ ܕܦܘܠܓܐ ܕܘܪܟܢܬܐ ܒܝܢ ܝܢܝܐ ܘܐܪܥܐ ܡܟܝܟܐ ܠܐܢܝܬܐ ܕܦܘܫܐ ܘܚܢ ܐܢܐ ܒܝ ܡܚܝܠܐ ܕܐܪܥܐ ܕܣܩܡܩܘܡܘ ٣٠ ܐܠܦܐ ܕܐܪܥܐ ܗܠܝܢܐ ܘܗܘܝܐ ܒܗܕܐ ܦܝܢ ܡܕܢܐ ܒܪܡܐ ܘܟܠܠܬܐ ܕܪܡܬܐ ܕܐܪܥܐ ܕܣܩܡܩܘܡܬܐ ܦܠܢܝܬܐ ܡܟܝܢ ܒܣܠܐ ܡܘܠܕܐ ܥܠܐ ܦܝܢ ܡܕܢܐ ܐܟܕܢܐ. ܘܦܪܫܐ ܥܠܘ ܦܘܠܓܐ ܠܗ ܝܢܝܐ (ܒܪܡܐ) ܐܠܐ ܕܐܠܠܐ ܥܠܘ ܦܘܠܓܐ ܒܝܢ ܝܢܝܐ ܘܐܪܥܐ (ܐܟܡܐ).

ܒ. ܠܒܪܬܐ ܕܦܘܠܓܐ

ܐ. ܩܕܡ ܦܘܠܓܐ

ܨܘܪܬܐ ٦ — ٦

ܘܠܡܬܚܪܬܐ ܡܢ ܡܬܚܐ ܕܪܡܫܐ ܡܦܠܣ ܒܪܟܐ ܣܦܪܐ ܒܢܝܢܐ ܒܥܘܠܡܗ ܟܠܗܐ ܟܠܐ ܟܠ ܒܢܝܢܐ ܘܦܫ ܐܘܡܬܐ ܒܐܠܐ ܣܠܡܢܐ ܘܦܠܚܬܐ ܗܘܦܗ ܐܣܟܐ ܒܐܪܟܐ ܕܦܝܫܬܐ. ܐܦ ܘܠܐ ܠܐ ܫܒܬܐ ܕܠܘܡܐ ܡܦܠܢܐ ܒܒܪܢܐ ܕܒܪܫܬܐ ܕܟܠܟܠܐ ܕܟܪܝܐ ܐܝܟ ܐܠܝܢܐ ܘܡܬܡܘܕܐ ܒܗܪܢܐ ܘܐܒܘܒܐ ܕܡܫܐ ܡܢ ܕܠܐ ܗܘܐ ܒܪܢܝܐ ܗܘܡܐ ܡܢܗ ܘܒܪܢܐ ܗܦܡܬܐ ܡܢ ܠܗ ܠܘܡܐ ܕܒܪܢܢܐ. ܐܦ ܒܝܒ ܙܦܣ ܠܗ ܝܬܒܬܐ ܠܗ ܪܕܝܬܐ ܡܢ ܟܠܝܬܐ ܠܒܪ ܡܢܗ ܘܡܫܬܐ ܠܗ ܒܗܦܘܬܐ ܒܡܝܬܝܐ ܕܐܐܪ ܪܒܕܝܐ. ܘܐܝ ܒܪܙܠܗ ܦܪܙܘܦܐ ܠܪܡܐ ܒܗܪܢܐ ܘܠܐ ܟܒܕܬܐ ܕܢܦܩܘܬܐ ܙܘܕܬܢܝܬܐ. ܘܦܪܒܬܐ ܕܝܪܕܗ ܡܢܒ ܕܦܝܒ ܡܒܘܢܐ ܠܡܢܛܪܘ. ܣܘܠܡܢܐ ܒܝܒ ܡܪܒܝܐ.

(٦ - ٨) ܫܒܝܠܐ ܕܗܘܪܢܐ

ܝܒܠܠܗ ܠܗ ܕܪܒܬܗ ܡܦܝܫܬܐ ܕܟܠ ܠܘܡܐ ܐܟܒܒ ܒܫܒܝܠܐ ܕܢܬܘܦܘܬܐ: ܐܪܟܬܐ ܐܟܒܒ ܒܣܠܐ ܝܡܦܐ ܙܝܒ ܙܘܒ ܠܟܣܬ ܘܦܒܠܗ ܡܪܢܐ ܐܗܐ ܣܠܐ ܕܡܟܒܒ ܟܠ ܠܘܡܐ ܢܦܠܐ ܝܘܡܪܐ ܕܠܘܡܐ ܘܐܦ ܒܠ ܒܣܘܢܬܐ ܕܗܪܒܢܬܐ ܠܠܝ ܠܗ ܡܟܒܒܪܘܢܬܐ ܕܗܪܒܢܐ ܠܗ ܪܘܫܐ ܒܪܝܒܐ ܒܗ ܐ. ܡܟܒܒ ܒܣܠܐ ܒܒܠ ܒܣܘܢܬܐ ܟܒܪܐ ܒܐܗܐ ܪܘܫܐ. ܗܘܐ ܠܠܘܝܬܐ ܐܘ ܗܘܡܬܐ ܘܝܒ ܐܗܐ ܣܠܐ ܟܠ ܕܐܗܐ ܒܣܘܢܬܐ ܒܡܢܐ ܕܡܪܒܢܐ ܐܗܐ ܒܣܘܢܬܐ ܡܢ ܒܣܘܢܬܐ ܡܘܠܕܢܬܐ ܠܫܒܝܠܐ ܒܠ ܐܘ ܝܒ ܐܗܐ ܣܠܐ ܒܝܒܬܐ ܕܟܠ ܡܢ ܐܢܐ ܐܪܝ ܒܣܘܢܝܬܐ ܠܦܘܬ ܡܢܗ. ܒܘܠܘܒ ܒܡܕ ܕܐܗܐ ܡܦܝܫܬܐ ܝܠܗ ܡܪܝܬܐ ܕܫܒܝܠܐ ܕܗܪܒܢܐ ܕܝܠܗ ܪܘܫܐ ܕܠܠܝ ܠܗܘ ܡܟܒܒܪܘܢܬܐ ܕܣܠܐ ܕܗܪܒܢܐ ܟܠ ܒܣܘܢܬܐ ܟܒܪܐ ܠܗܘ.

ܘܡܢܐ ܕܪܒܬܐ ܕܒܝܠܬܐ ܕܫܒܝܠܐ ܕܗܪܒܢܐ ܒܒܠ ܢܘܡܝܬܐ ܦܒܠܗ ܣܒܝܒܬܐ ܗܘܝܬܐ ܕܒܣܘܢܬܐ ܢܘܡܝܬܐ ܗܘܡܬܐ ܪܒܢܐ ܝܟܘܪܬܐ ܦܒܠܗ ܡܪܝܬܐ ܒܐܘܝܬܐ ܒܒܣܘܢܬܐ ܢܫܢܝܬܐ ܐܝܟܐ ܕܡܦܝܫܬܐ ܝܠܗ ܒܒܡܬܐ ܕܡܟܒܒܪܘܢܬܐ ܕܫܒܝܠܗ ܕܗܪܒܢܐ ܠܦܘܬ ܫܒܝܠܐ ܕܒܣܘܢܬܐ ܡܘܠܕܢܬܐ ܘܐ. ܬܘܡܟܒܒܠܗ ܒܣܘܢܬܐ ܢܫܢܝܬܐ ܒܣܠܐ ܘܝܒܠܗ ܡܗܘܐܠܗ ܐܗܐ ܟܠ ܗܘܝܬܐ ܕܫܒܝܠܐ ܒܐܗܐ ܢܘܡܝܬܐ.

ܘܫܒܝܠܐ ܕܗܪܒܢܐ ܡܦܝܫܢܐ ܝܠܗ ܐܝܟ ܕܝܠܗ ܐܝܬܝܘܬܐ ܠܗ ܫܒܝܠܐ ܕܢܬܘܦܘܬܐ ܘܗܘܐ ܙܘܒܗ ܒܦܘܒܐ ܕܦܘܠܛܐ ܕܣܠܐ ܕܗܪܒܢܐ ܕܡܟܒܒܝ ܟܠ ܒܣܘܢܬܐ ܢܫܢܝܬܐ ܘܫܒܝܠܐ ܗܘܐ ܗܘܡܐ ܐܝܡ ܕܦܠܛ ܡܢ ܒܣܘܢܬܐ ܗܘܡܬܐ ܘܫܒܝܠܐ ܗܘܐ ܠܠܘܝܐ ܐ. ܦܠܛܠܗ ܡܢ ܒܣܘܢܬܐ ܠܠܘܝܬܐ.

ܘܚܝܠܐ ܚܫܡܠܝܐ ܠܐ ܡܬܚܙܝܢܐ ܡܬܚܫܒܢܝܬܐ ܘܐܝܟ ܒܣܘܪ̈ܛܐ ܙܠܝܩܝܐ ܦܫܛ ܗܕܐ ܒܣܘܪ̈ܛܐ ܕܚܝܠܐ ܚܫܡܠܝܐ ܘܣܘܪܛܐ ܕܚܝܠܐ ܚܫܡܠܝܐ ܠܐ ܣܘܪܛܐ ܙܠܝܩܝܐ ܕܢܦܠ ܒܫܘܒܐ ܢܩܘܕܬܐ ܒܡܨܥܬܐ ܕܐܘܠܐ ܠܗ ܚܝܠܐ ܚܫܡܠܝܐ ܠܗ ܡܬܢܦܩ ܒܐܝܕܐ ܠܚܝܠܐ ܘܐܦܐ ܣܘܪ̈ܛܐ ܒܡܬܚܒܟ ܒܡܐ ܕܐܬܐ:

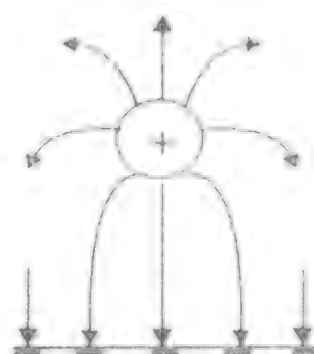
١ . ܢܦܠ ܡܢ ܒܫܘܒܐ ܫܘܡܐ ܒܡܘܕܝܐ ܠܡܘܕܝܐ ܠܠ ܒܫܡܐ ܒܫܘܒܐ ܕܢܦܠ ܙܘܓ ܒܫܘܒܐ ܠܠܘܝܐ ܠܡܘܕܝܐ ܠܠ ܒܫܡܐ ܒܫܘܒܐ ܒܠܠܘܝ.

٢ . ܡܠܦܢܐ ܠܣܘܪܛܐ ܕܚܝܠܐ ܒܟܠ ܢܩܘܕܬܐ ܦܫܛ ܠܚܝܠܐ ܚܫܡܠܝܐ ܒܐܝܕܐ ܢܩܘܕܬܐ.

٣ . ܣܘܪ̈ܛܐ ܕܚܝܠܐ ܚܫܡܠܝܐ ܠܐ ܡܬܚܒܟ ܚܕ ܥܡ ܚܕܢܐ. ܐܠܐ ܢܦܩ ܘܦܠܓ ܕܒܡܠܟ ܡܘܕܝܐ ܒܟ ܒܕܢܐ ܗܘܐ ܡܬܢܝܚܐ.

٤ . ܡܢܝܢܐ ܕܣܘܪ̈ܛܐ ܠܡܘܕܝܐ ܠܚܕܢܐ ܡܢ ܫܘܚܠܦܐ ܕܒܫܘܚܠܦܐ ܕܚܝܠܐ ܢܩܘܕܬܐ ܡܬܚܫܒܬܐ. ܗܢܐ ܘܕܡ ܫܘܚܠܦܐ ܕܣܘܪ̈ܛܐ ܕܚܝܠܐ ܚܫܡܠܝܐ. ܦܫܛܐ ܕܐܡܝܢ ܥܡ ܟܘܠ ܕܚܝܠܐ ܒܐܝܕܐ ܢܩܘܕܬܐ ܡܬܚܫܒܬܐ.

٥ . ܐ . ܗܘܐ ܠܚܝܠܐ ܡܬܦܫܛܐ ܒܡܬܚܙܝ ܣܘܪ̈ܛܐ ܕܚܝܠܐ ܚܫܡܠܝܐ ܦܫܝܛܐ ܠܗܘ. ܐܠܐ ܠܐ ܢܦܩ ܠܗ ܚܝܠܐ ܠܐ ܡܬܦܫܛܐ ܘܐܣܟܡܐ (٦ - ٧) ܦܫܛ ܐܣܟܡܐ ܕܣܘܪ̈ܛܐ ܕܚܝܠܐ ܚܫܡܠܝܐ ܠܚܝܠܐ ܒܐܝܕܘܬܐ ܦܫܝܛܐ.





ܗ) ܫܒ݂ܝܼܠܹ̈ܐ ܡܓ݂ܢܛܝܼܣܝܹ̈ܐ ܡܬ݂ܟܫܦܐ ܒܝܢ
ܬܪ̈ܝ ܠܘܚܹ̈ܐ ܡܙܘܓܵܐ ܒܚܕ݂ܕ݂ܐ

(٦ - ٩) ܥܒ݂ܘܼܝܵܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܡܓ݂ܢܛܝܼܣܝܹ̈ܐ ܒܢܘܼܩܙܬܵܐ (ܛܣܠ)

ܥܒ݂ܘܼܝܵܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܡܓ݂ܢܛܝܼܣܝܹ̈ܐ ܒܢܘܼܩܙܬܵܐ ܝܠܗ ܦܫܝܼܛܘܼܬܵܐ ܕܡܢܝܢܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܡܓ݂ܢܛܝܼܣܝܹ̈ܐ ܡܥܒ݂ܪܢܹ̈ܐ ܥܠ ܚܕ݂ ܦܣܬܵܐ ܡܓ݂ܢܛܝܼܣܝܬܵܐ ܡܘܫܚܬܵܐ ܬܪ̈ܝ ܢܘܼܩܙܬܵܐ ܠܡܫܘܚܬܵܐ ܕܗ̄ܝ ܦܣܬܵܐ ܦܫܝܛܬܵܐ ܕܦܣܬܵܐ ܢܨܝܼܒ݂ܬܵܐ ܥܠܬܵܐ ܡܘܫܚܬܵܐ ܬܪ̈ܝ ܢܘܼܩܙܬܵܐ ܐܢܐ ܫܒ݂ܝܼܠܹ̈ܐ ܘܡܬ݂ܚܫܒܐ ܝܠܗ ܡܬ݂ܩܪܒܘ ܒܡܢܝܢܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܡܥܒ݂ܪܢܹ̈ܐ ܥܠ ܚܕ݂ܘܬܵܐ ܕܦܣܬܵܐ ܢܨܝܼܒ݂ܬܵܐ ܩܘܡܬ݂ ܡܘܫܚܐ ܚܕ݂ ܡܢ ܢܘܼܩܙܐ ܕܫܒ݂ܝܼܠܐ.

$$\text{ܥܒ݂ܘܼܝܵܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܡܓ݂ܢܛܝܼܣܝܹ̈ܐ} = \frac{\text{ܦܘܠܓ݂ܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܡܓ݂ܢܛܝܼܣܝܹ̈ܐ ܡܥܒ݂ܪܢܹ̈ܐ}}{\text{ܡܫܘܚܬܵܐ ܕܦܣܬܵܐ ܢܨܝܼܒ݂ܬܵܐ (ܦ)}}$$

ܐܢ ܫܒ݂ܝܼܠܐ ܗܘܐ (ܫ) ܘܦܣܬܵܐ (ܦ ܕ) ܒܡܘܠܕܐ ܥܒ݂ܘܼܝܵܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܦܝܫ ܡܘܠܕܐ ܒܦܣܬܵܐ ܡܘܠܕܐ

$$\text{ܗܕ݂ܝ ܥܒ݂ܘܼܝܵܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܡܓ݂ܢܛܝܼܣܝܹ̈ܐ ܥܒ݂ܘ} = \frac{\text{ܫܒ݂ܝܼܠܐ ܫ}}{\text{ܦܣܬܵܐ (ܦ ܕ)}} \quad ...(٦ — ٣)$$

ܟܕ ܫܒ݂ܝܼܠܹ̈ܐ ܡܓ݂ܢܛܝܼܣܝܹ̈ܐ ܝܠܗ ܡܫܘܚܬܵܐ ܡܢܘܼܩܙܬܵܐ ܘܙܘܥܗ ܒܟܠ ܢܘܼܩܙܬܵܐ ܗܘܐ ܡܢܘܩܙܐ ܕܦܘܠܓ݂ܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܡܥܒ݂ܪܢܹ̈ܐ ܥܠ ܦܣܬܵܐ ܡܘܫܚܬܵܐ ܗܕ݂ܝ ܢܘܼܩܙܬܵܐ ܒܗܕ ܕܗ̄ܝ ܡܢܘܩܙܐ ܝܠܗ ܦܫܝܼܛܬܵܐ ܕܥܒ݂ܘܼܝܵܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܒܟܠܝܐ ܙܘܥܗ ܦܫܝܼܛ ܙܘܥܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܒܗ̄ܝ ܢܘܼܩܙܬܵܐ ܘܡܬܒܗ ܦܫܝܼܛ ܥܒ݂ܘܼܝܵܐ ܕܫܒ݂ܝܼܠܹ̈ܐ ܒܗ̄ܝ ܢܘܼܩܙܬܵܐ

ܘܟܠܐ ܟܡܐ ܕܟܒܠܐ ܕܡܘ̈ܒܠܢܐ ܠܐ ܦܫܛܐ ܥܠ ܚܡܘܬܐ ܕܫܠܗܒܝܬܐ ܕܚܝܠܐ ܕܡܘ̈ܒܠܢܐ ܟܕ̈ܝܢܐ ܡܢ ܐܝܟܐ ܦܫܛܐ ܘܡܢ ܒܕܝܠܗ ܒܗܘ ܕܐܝܟܐ ܦܫܛܐ ܣܩܝܠܬܐ ܚܡܘܬܐ ܕܫܠܗܒܝܬܐ ܕܚܝܠܐ ܕܡܘ̈ܒܠܢܐ ܡܬܘܣܦܐ ܠܟܡܐ ܕܟܒܠܐ.

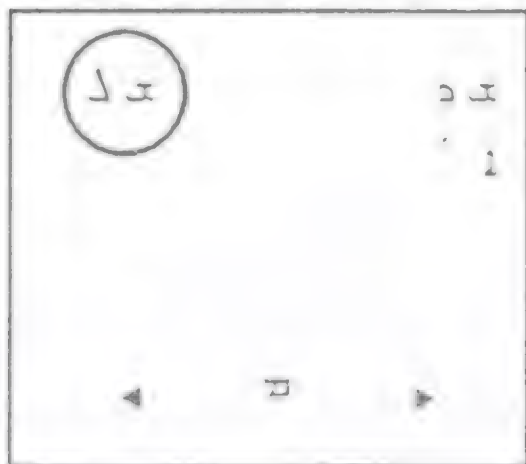
ܐܠܐ ܚܡܘܬܐ ܕܫܠܗܒܝܬܐ ܕܚܝܠܐ ܕܡܘ̈ܒܠܢܐ ܠܐ ܡܫܢܝܐ ܕܫܠܗܒܝܬܐ ܕܚܝܠܐ ܕܡܘ̈ܒܠܢܐ ܕܟܒܠܐ܆ ܒܡܘܕܥܝܬܐ ܡܢ ܠܗ ܣܦܝܩܘܬܐ ܕܥܒܝܕܘܬܐ ܐܠܐ ܐ܆ ܫܠܗܒܝܬܐ ܗܘܘ ܒܝܬ ܥܠ ܛܒܥܐ ܦܫ ܥܡܠܐ ܡܬܟܢܘ ܒܡܘܕܥܐ ܥܠ ܛܒܥܐ.

(٦ - ١٠) ܟܒܠܐ ܕܡܘ̈ܒܠܢܐ ܡܚܦܝܐ ܘܠܐ ܡܚܦܝܐ

ܟܒܠܐ ܕܡܘ̈ܒܠܢܐ ܡܚܦܝܐ ܠܝܬ ܟܒܠܐ ܕܗܘܐ ܟܡܐ ܕܟܒܠܐ ܠܗܘ ܗܘ ܡܬܝܕܥܐ ܒܟܠܗ ܢܦܫܗ ܒܗܘ ܕܐܝܟܐ ܫܠܗܒܝܬܐ ܕܚܝܠܐ ܕܡܘ̈ܒܠܢܐ ܠܗܘ ܗܘ ܡܬܝܕܥܢܐ ܘܡܚܦܝܐ ܕܚܡܘܬܐ ܘܡܬܝܕܥܬܐ ܠܝܬ ܡܫܢܝܐ ܥܠ ܟܒܠܐ ܡܚܦܝܐ ܒܟܪ̈ܝܐ ܕܥܒܕܐ ܕܟܕ ܠܗܘ ܡܬܝܕܥܢܐ ܗܕܘܢܝܐ ܕܗܘܐ ܒܟܕܝ ܥܡܘܕܬܐ ܦܪ̈ܟܐ ܐܝܟ ܕܒܪܝܐ ܠܗ ܥܒܕܐ ܕܡܬܚܙܝܐ ܐܬܚܙܝ (٦ - ٦) ܐܠܐ ܟܒܠܐ ܕܡܘ̈ܒܠܢܐ ܠܐ ܡܚܦܝܐ ܠܝܬ ܗܘ ܟܒܠܐ ܕܥܒܕ ܟܡܐ ܒܝܢ ܢܦܫܗ ܘܐܚܪܢܐ ܐܝܟ ܟܒܠܐ ܒܪ̈ܝܐ ܚܕܐ ܠܗܘܕܐ ܥܡܝܩܬܐ ܒܗܘ ܕܐܝܟܐ ܟܡܐ ܕܟܒܠܐ ܕܥܡܘܕܬܐ ܕܠܗܘܕܐ ܗܕܐ ܕܒܫܡܫ ܡܢܗ ܠܚܡܘܬܐ ܕܫܠܗܒܝܬܐ ܕܚܝܠܐ ܕܡܘ̈ܒܠܢܐ ܕܒܗܘ ܐܬܚܙܝ (٦ - ٧).

(٦ - ١١) ܫܘܚܠܦܐ ܕܟܡܐ ܕܟܒܠܐ ܕܡܘ̈ܒܠܢܐ ܒܥܘܡܩܐ ܠܒܪ ܕܛܒܥܐ ܕܠܗܘܕܐ ܡܬܝܕܥܐ

ܐ. ܡܬܬܟܠ ܥܡܘܕܬܐ ܒܡܘܠܐ (ܥ ܠ) ܥܠ ܠܗܘܕܐ ܡܬܚܙܝܢܝܬܐ ܐܝܟ ܡܬܚܘܝܐ ܒܐܬܚܙܝ (٦ - ٨) ܘܡܬܝܕܥ ܦܠܓܘܬܐ ܕܟܡܐ ܕܟܒܠܐ ܕܡܘ̈ܒܠܢܐ ܒܥܘܡܩܐ (ܐ) ܕܟܕܟܕܐ (ܡ) ܡܢ ܡܛܠܬܗ ܕܠܗܘܕܐ ܥܡܘܕܬܐ ܒܥܒܝܕ ܗܘܝܐ ܕܥܡܘܕܬܐ ܢܩܫܬܐ ܐܝܟ (ܥ ܒ) ܡܬܝܕܥܬܐ ܒܥܘܡܩܐ (ܐ) ܘܚܝܠܐ ܡܟܕܟܢܐ ܒܗܝ ܥܡܘܕܬܐ ܡܬܚܙܝܐ ܠܗ ܫܟܝܢܬܐ ܒܡܬܚܙܝܬܐ ܕܗܢܘ ܕܡܘܠܘܡ.



ܐܬܚܙܝ (٦ — ٨)

$$ܣ = ܐܡ \times \frac{ܥ_{١} \times ܥ_{٢}}{ܡ^{٢}}$$

$$ܘܟܕ\ ܟܡܐ = \frac{ܣ}{ܥ}$$ ܡܢ ܡܛܠܬܐ ܕܟܡܐ ܕܡܘ̈ܒܠܢܐ

$$\text{ܚܝܠܐ ܕܓܪܓܪܬܐ ܚܫܡܠܝܬܐ ܐ} = \text{ܩܐ} \times \frac{\frac{\text{ܒܠ} \times \text{ܒܕ}}{\text{ܡ}^{2}}}{\text{ܒܕ}} = \text{ܩܐ} \times \frac{\text{ܒܠ}}{\text{ܡ}^{2}}$$

$$\text{ܚܝܠ} = \text{ܩܐ} \times \frac{\text{ܒܠ}}{\text{ܡ}^{2}}$$

ܘܐܝܟ ܗܢܐ܆ ܠܚܫܒܢܐ ܕܚܝܠܐ ܕܓܪܓܪܬܐ ܕܥܒܕܐ ܚܫܡܠܝܬܐ ܒܢܩܕܬܐ (ܡ) ܡܢ ܡܘܒܠܐ ܢܩܘܕܢܝܬܐ ܐܘ ܡܘܒܠܐ ܥܠ ܦܘܪܫܐ ܡܫܬܘܕܥܬܐ ܗܘ ܗܝܠܘ (ܒ ܠ) ܘܡܛܠ ܡܘܦܠܫܬܐ ܐܝܟ ܐܝܢܐ ܕܐܫܬܘܕܥ ܐܦ ܥܠ ܢܩܘܕܬܐ ܕܝܗܒܢ ܕܦܘܪܫܐ ܡܘܒܠܐ ܒܗܘ.

ܐܠܐ ܚܝܠܐ ܕܓܪܓܪܬܐ ܕܥܒܕܐ ܠܗ ܦܘܪܫܐ ܡܫܬܘܕܥܬܐ ܡܘܒܠܐ ܕܗܘ ܩܘܡܐ ܒܗ ܠܗ ܦܘܪܫܐ ܩܘܡܐ ܗܘ ܡܘܒܠܐ.

ܦܘܬܚܐ (٣)

ܦܘܪܫܐ ܡܘܒܠܐ ܕܗܝܠܐ ܕܡܘܒܠܗ ١٠٠ ܡܝܟܪܘܟܘܠܘܡ ܘܡܛܠܐ ܕܡܫܘܚܬܗ ١ ܡ ܐܝܟ ܚܝܠܐ ܕܓܪܓܪܬܐ ܕܥܒܕܐ ܚܫܡܠܝܬܐ ܒܢܩܕܬܐ ٥٠ ܣܢܬܝܡܛܪܐ ܡܢ ܡܨܥܬܗ܆ ܘܚܝܠܐ ܕܓܪܓܪܬܐ ܕܥܒܕܐ ܥܠ ܝܗܒܗ܆ ܘܚܝܠܐ ܕܓܪܓܪܬܐ ܕܥܒܕܐ ܚܫܡܠܝܬܐ ܠܗ ܦܘܪܫܐ:

ܒܥܠܬܐ $$\text{ܚܝܠ} = \text{ܩܐ} \times \frac{\text{ܒܠ}}{\text{ܡ}^{2}}$$

$$= ٩ \times ١٠^{٩} \times \frac{\text{ܢܛ ܡ}^{2}}{\text{ܟܠ}^{2}} \times \frac{١٠٠ \times ١٠^{-١٢} \text{ ܟܠ}}{(٥٠ \times ١٠^{-٢})^{2} \text{ ܡ}^{2}}$$

$$= ٣{,}٦ \times \frac{\text{ܢܛ}}{\text{ܟܠ}}$$ ܚܝܠܐ ܕܓܪܓܪܬܐ ܚܫܡܠܝܬܐ ܒܢܩܕܬܐ ٥٠ ܣܡ ܡܢ ܡܨܥܬܗ ܕܦܘܪܫܐ

$$٣)\ \text{ܚܝܠ} = \text{ܡܟ} \times \frac{\text{ܙ ܠ}}{\text{ܡ}^{٢}}$$

$$= ٩ \times ١٠^{٩} \times \frac{\text{ܢܡ . ܡ}^{٢}}{\text{ܟܠ}^{٢}} \times \frac{١٠٠ \times ١٠^{-١٢}\ \text{ܟܠ}}{(١ \times ١٠^{-٢})^{٢}\ \text{ܡ}^{٢}}$$

$$= ٩ \times ١٠^{٣}\ \frac{\text{ܢܡ}}{\text{ܟܠ}^{٢}}$$

(٣) ܬܘܪܐ ܕܫܒܝܒܠܐ ܐܘ ܥܘܒܕܐ = ܡܫܚܐ ܟܕ ܐܘ ܥܘܒܕܐ ܟܢܝܫܐ (ܩܢܘܡܐ) ܡܫܚܐ ܠܗ ܡܢ ܟܢܘܫܬܐ.

ܫܘܐܠܐ (٤)

ܫܒܝܒܠܐ ܕܡܙܪܩܐ ܡܫܚܠܦܐ ܚܝܠܗ (٤٠٠٠) ܐܡܦܝܪ ܢܫܡܐ ܕܡܙܪܩܐ ܡܫܚܠܦܐ ܕܐܠܟܬܪܘܢ. ܟܡܐ ܟܡܝܘܬܐ ܫܒܝܒܠܐ ܟܕ ܐܡܦܝܪ ܡܢܝܢܐ ܕܡܝܬܝܠܗ ܐܢܐ ܐܠܟܬܪܘܢ. ܒܙܒܢܐ ܕܗܘܝܐ ܡܬܚܫܒܬܐ (٥ ܡܙ) ܒܙܒܢܐ ܕܫܒܝܒܠܐ ܠܫܒܝܒܠܐ؟

ܫܪܝܐ

$$\text{ܚܝܠ} = \frac{\text{ܫ}}{\text{ܙ}} \qquad \text{ܫ} = \text{ܚܝܠ} \times \text{ܙ}$$

$$\text{ܫ} = ٤٠٠٠\ \frac{\text{ܢܡ}}{\text{ܟܘܠܘܡ}} \times ١.٦ \times ١٠^{-١٩}\ \text{ܟܘܠܘܡ}$$

$= ٦،٤ \times ١٠^{-١٦}$ ܢܡ ܢܫܡܐ ܡܫܚܠܦܐ ܕܐܠܟܬܪܘܢ.

ܙܒ = ܫ ܡܢ (ܟܕ ܫ ܡܬܝܗܒܐ ܠܗ ܒܙܒܢܐ ܕܡܬܚܫܒܬܐ ܕܫܒܝܒܠܐ)

$= ٦،٤ \times ١٠^{-١٦} \times ٥ \times ١٠^{-٢}$

$= ٣٢ \times ١٠^{-١٨}$ ܟܠ ܡܢܝܢܐ (ܟܘܠܠܐ) ܕܡܝܬܝܠܗ ܐܠܟܬܪܘܢ.

ܡܘܦܩܐ (٥)

ܗܕܐ ܫܘܢܩܬܐ ܢܘܗܪܢܝܬܐ ܕܠܚܕܐ ܡܝܬܝܐ (+١) ܡܟܠ ܘܡܟܠܝܕܐ ܒܝܢܬܐ ܒܬܪ ܚܝܠܐ ܕܦܠܓܐ ܕܡܕܢܚܐ ܒܢܘܗܪܐ ܡܢ ܢܘܗܪܐ ܕܚܕܐ ܡܫܠܡܢܬܐ ܒܝܢ ܕܬܪܝܢ ܫܘܢܩܬܐ ܐܝܟܐ ܕܐܝܬ (٠,٥) ܡ ܡܢ ܫܘܢܩܬܐ ܩܕܡܝܬܐ ܘܐܝܟܐ ܡܢ ܫܘܢܩܬܐ ܬܪܝܢܝܬܐ ١,٥ ܡ؟

ܫܪܝܐ

ܡܐ ܕܡܚܘܝܐ ܦܘܠܚܢܐ ܕܦܠܓܐ ܕܢܘܗܪܐ ܐ (ܨܘܪܬܐ ٦ - ٩) ܒܝܢܬܝܢ ܘܐܝܬܐ ܕܫܘܢܩܬܐ ܢܡܘܣܝܬܐ ܕܗܘܐ ܢܘܗܪܐ.

ܚܝܠ = ܚܝܠ₁ ܚܝܠ₂ (ܒܗܝ ܕܐܝܟܐ ܦܠܓܐ ܘܦܬܐ ܚܕܝܐ)

$$\text{ܚܝܠ} = \text{ܩܡ}\left(\frac{\text{ܫ}_{١}}{\text{ܡ}_{١}^{٢}} - \frac{\text{ܫ}_{٢}}{\text{ܡ}_{٢}^{٢}}\right)$$

$$\text{ܚܝܠ} = ٩ \times ١٠^{٩}\ \frac{\text{ܢܡ}.\text{ܡ}^{٢}}{\text{ܟܠ}^{٢}}\left(\frac{١ \times ١٠^{-٦}}{(٠,٥)^{٢}} - \frac{١ \times ١٠^{-٦}}{(١,٥)^{٢}}\right)\ \frac{\text{ܟܠ}}{\text{ܡ}^{٢}}$$

$$= +٣,٢ \times ١٠^{٤}\ \frac{\text{ܢܘܛܢ}}{\text{ܟܘܠܘܡ}}$$ ܦܘܠܚܢܐ ܕܚܝܠܐ ܕܡܕܢܚܐ ܒܢܘܗܪܐ ܘܐܝܟ ܠܝܡܝܢܐ

(ܨܘܪܬܐ ٦ — ٩)

٦.١٢ ܟܘܒܢܐ ܕܘܪܟܢܐ

ܡܫܢܝܬܐ ܝܠܗ ܡܕܡܚܬܐ ܕܟܘܒܢܐ ܕܘܪܟܢܐ ܒܟܘܒܢܐ ܕܡܫܕܝܬܐ ܠܚܕܐ ܕܟܘܬܠܐ ܕܒܘܐ ܒܘܫܠܦܐ ܒܬܘܩܦܐ ܟܡܝܢܐ ܕܐܗܐ ܚܕܐ. ܐ. ܚܒܒܠ ܕܠܘܒܟܐ ܟܘܬܠܗ (ܐ ܟܒܡ) ܟܢܘܫܬܐ (ܐ) ܕܪܚܩܐ (ܠ) ܡܢ ܒܗܫܐ ܕܐܪܥܐ ܐܝܟ ܒܨܘܪܬܐ (٦ ـ ١٠).

ܨܘܪܬܐ (٦ — ١٠)

ܬܘܩܦܐ ܟܡܝܢܐ = ܐ × ܠ × ܣ

ܟܕ (ܣ) ܝܠܗ ܡܫܘܚܬܐ ܐܪܥܢܐ.

ܐ. ܒܫܢܠ ܡܫܡܫܬܐ ܕܐܗܐ ܠܘܒܟܐ ܠܟܢܘܫܬܐ (ܒ) ܕܪܚܩܐ ܥܠ ܟܢܘܫܬܐ (ܐ) ܒܐܠܦܐ ܒܚܕܐ ܕܟܘܬܠܐ ܡܫܘܚܬܐ ܥܠܗ ܒܗܐ ܬܘܩܦܐ ܟܡܝܢܐ ܘܕܢܐ ܕܡܢܝܠܗ ܐܗܐ ܠܘܒܟܐ ܒܗܘ ܕܐܗܐ ܦܝܫܐ ܐܡܝܕܬܐ ܕܬܘܩܦܐ ܟܡܝܢܐ ܕܠܘܒܟܐ ܒܟܢܘܫܬܐ (ܒ) ܒܕ ܪܚܩܐ ܝܠܗ ܡܢ ܬܘܩܦܐ ܟܡܝܢܐ ܠܗ ܒܟܢܘܫܬܐ (ܐ) ܒܗܘ ܝܕܥܠܢ ܒܘܠܠܐ ܘܕܢܐ ܕܡܫܘܚܠ ܒܬܘܦܘܬܐ ܐܪܥܢܬܐ ܘܡܘܪܒܢܐ ܕܬܘܩܦܐ ܟܡܝܢܐ ܕܠܘܒܟܐ ܒܝܢ ܬܪܬܝܢ ܟܢܘܫܬܐ (ܒ ، ܐ) = ܬܘܩܦܐ ܟܡܝܢܐ ܠܗ ܒ - ܬܘܩܦܐ ܟܡܝܢܐ ܠܗ ܐ = ܒܘܠܠܐ ܝܪܦܐ ܕܡܫܘܚܠ ܒܬܘܦܘܬܐ ܐܪܥܢܬܐ ܠܟܬܝܬܐ ܕܠܘܒܟܐ ܒܝܢ ܒ ܠ ܐ.

ܘܦܝܫ ܡܕܢܐ ܬܘܩܦܐ ܟܡܝܢܐ ܕܡܫܕܝܬܐ ܠܚܕܐ ܕܟܘܬܠܐ ܡܢ ܐ ܠ ܒ ܒܦܘܪܫܢܐ ܕܟܘܒܢܐ ܕܡܫܕܝܬܐ ܐܦ ܦܝܫ ܡܕܢܐ ܬܘܩܦܐ ܟܡܝܢܐ ܕܡܫܕܝܬܐ ܠܚܕܐ ܕܟܘܬܠܐ ܒܚܠ ܟܢܘܫܬܐ ܒܟܘܒܢܐ ܕܡܫܕܝܬܐ.

ܒ. ܚܒܒܠ ܗܘܝܬܐ ܕܒܚܘܢܬܐ ܟܘܪܒܬܐ ܡܫܘܡܬܐ ܐܝܟ (ܒ ܠ) ܐܝܟ ܒܨܘܪܬܐ (٦ ـ ١١) ܒܚܘܢܬܐ ܡܫܘܡܬܐ (ܒ ܓ) ܕܐܝܬ ܒܟܢܘܫܬܐ (ܒ) ܗܘܝܐ ܡܬܒܒܪܢܬܐ ܒܢܝܫܠܐ ܕܘܪܟܢܐ ܠܚܘܢܬܐ (ܒ ܠ) ܠܦܘܬ ܡܢܗ ܒܟܠܗܘܢ (ܐܦ ܡܒܒܒ ܠܘܒܟܐ ܒܚܠܐ ܕܢܘܡܪܐ ܦܠܓܐ ܕܢܝܫܠܐ ܕܬܘܦܘܬܐ ܐܪܥܢܬܐ).

ܨܘܪܬܐ (٦ — ١١)

ܒܗܘ ܕܐܘܐ ܐܘܐ ܥܡܘܪܬܐ ܐܝܟܠܘ ܗܘܦܩܐ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ ܡܫܚܠܦܐ ܘ. ܒܕܠܝ ܫ̈ܢܝܬܐ ܕܐܘܐ ܥܡܘܪܬܐ ܘܡܫܘܚܠܦܘ ܠܒܘܣܝܬܐ (ܐ) ܒܫܘܡܫ ܠܡܬܚܡܬܐ ܕܒܘܝܠܐ ܠܘܚܕܬܐ ܝܠ ܫܢܬܐ ܕܝܦܩܬܐ ܘܒܫܠܡ ܐܦ ܐܘܐ ܒܘܝܠܐ ܠܗܘܦܩܐ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ ܘܟܝܪܐ ܡܢܠܘ ܥܡܘܪܬܐ (ܒ ܕ) ܒܒܘܣܝܬܐ (ܐ) ܒܗܘ ܕܐܘܐ ܦܬܐ ܐܡܝܬܬܐ ܕܗܘܦܩܐ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ ܕܥܡܘܪܬܐ (ܒ ܕ) ܝܢ (ܐ) ܒܝܕ ܕܬܐ ܝܠܘ ܡܢ ܗܘܦܩܘ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ ܝܢ (ܒ) ܒܗܘ ܕܐܘܐ ܡܝܬܬܐ ܝܠܘ ܡܝܬܝܬܐ ܕܟܘܡܝ̈ܢܐ ܕܟܘܪ̈ܗܢܐ ܒܒܘܣܝܬܐ.

ܝܠܘ ܦܫܘܛܬܐ ܕܗܘܦܩܐ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ ܠܥܡܘܪܬܐ ܒܒܘܣܝܬܐ ܝܢ ܠܡܝܬܝܬܐ ܕܟܘܪ̈ܗܢܐ ܠܒܘܝܠܐ ܕܐܘܐ ܥܡܘܪܬܐ ܘܟܘܡܝ̈ܢܐ ܕܟܘܪ̈ܗܢܐ ܝܠܘ ܡܢ ܚܡܫܘܬܐ ܠܐ ܙܘܒܢܐ.

$$\text{ܗܘܐ ܘܟܝܪ ܠܟܘܡܝ̈ܢܐ ܕܟܘܪ̈ܗܢܐ (ܒ)} = \frac{\text{ܗܘܦܩܐ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ (ܒܘܝܠܐ)}}{\text{ܥܡܘܪܬܐ ܡܫܬܟܚܬܐ}} \quad \ldots (٦ - ٤)$$

ܐ. ܦܝܠܘ ܚܝܠܬܐ ܥܡܘܪܬܐ ܒܚܘܠܘܡ ܘܒܘܝܠܐ ܒܝܘܡ ܫܢܝܘܬܐ ܕܟܘܡܝ̈ܢܐ ܝܠܘ $\frac{\text{ܝܘܡ}}{\text{ܚܘܠܘܡ}}$ ܘܐܘܐ ܫܢܝܘܬܐ ܦܬܐ ܡܢܝܬܐ (ܒܘܠܝܢ) ܘܗܘܐ ܠܟܘܡܝ̈ܢܐ ܦܘܫܩܐ ܐ. ܒܕܐܠܘ ܡܢ ܥܡܘܪܬܐ ܦܘܫܩܐ ܘܗܘܐ ܝܠܘܦܐ ܐ. ܒܕܐܠܘ ܡܢ ܥܡܘܪܬܐ ܝܠܘܦܬܐ ܘܝܘܦܩܐ ܒܐܡܦܡܐ (٦ - ١١) ܝܘܡ ܠܟܘܡܝ̈ܢܐ ܦܘܫܩܐ ܒܗܝ ܒܚܕܠܝ ܒܘܝܠܐ ܠܫ̈ܢܝܬܐ ܕܥܡܘܪܬܐ ܘܫܘܡܠܐܘ ܗܘܦܩܐ ܕܟܘܪ̈ܗܢܐ ܘܟܝܪܐ.

(٦ ـ ١٣) ܦܘܪ̈ܫܢܐ ܕܟܘܡܝ̈ܢܐ ܕܟܘܪ̈ܗܢܐ

ܐ. ܕܝܕܠܝ ܠܐܡܦܡܐ (٦ ـ ١١) ܒܡܫܘܚܠܦ ܕܗܘܦܩܐ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ ܕܥܡܘܪܬܐ (ܒ ܕ) ܝܢ (ܒ) ܒܝܕ ܦܪܘܫܐ ܝܠܘ ܡܢ ܗܘܦܩܐ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ ܠܘ ܝܢ (ܐ) ܒܗܘ ܕܐܘܐ ܠܟܘܡܝ̈ܢܐ ܕܟܘܪ̈ܗܢܐ ܒܒܘܣܝܬܐ (ܒ) ܒܝܕ ܦܪܘܫܐ ܝܠܘ ܝܢ ܒܘܣܝܬܐ (ܐ) ܘܦܝܫ ܡܕܐ ܦܘܪ̈ܫܢܐ ܒܝܢ ܟܘܡܝ̈ܢܐ ܕܗܕܘܝܗ ܒܘܣܝܬܐ (ܐ . ܒ) ܒܦܘܪ̈ܫܢܐ ܕܟܘܡܝ̈ܢܐ ܕܟܘܪ̈ܗܢܐ ܒܝܢܬܝܗ ܘܦܝܫ ܡܬܒܝܢܐ ܐܝܟ ܒܐܫܘܘܬܐ $P_{12} = P_1 - P_2$ ܡܢ ܡܢ ܒܚܕܠܘ ܡܝܘܢܬܐ ܝܠܘ ܡܬܒܕܕܬܐ ܕܦܘܪ̈ܫܢܐ ܕܟܘܡܝ̈ܢܐ ܕܟܘܪ̈ܗܢܐ ܒܝܢ ܬܪܝܢ ܒܘܣܝ̈ܬܐ ܕܝܠܘ ܦܘܪ̈ܫܢܐ ܝܢ ܗܘܦܩܐ ܚܕ̈ܬܐ ܕܟܘܪ̈ܗܢܐ ܠܫܢܝܘܬܐ ܕܥܡܘܪܬܐ ܒܝܢ ܐܢܐ ܬܪܝܢ ܒܘܣܝܬܐ ܘܝܠܘ ܒܘܝܠܐ ܕܒܘܝܠܐ ܐܢܫܐ ܠܫ̈ܢܝܬܐ ܕܥܡܘܪܬܐ ܕܟܘܪ̈ܗܢܐ

ܦܘܡܕܐ ܡܢ ܚܕܐ ܡܢ ܬܪܘܝܗܝ ܢܘܩܙܐ ܠܐܚܪܢܐ ܡܫܘܚܠܦܢܐ ܥܠ ܟܘܠܐ ܕܐܗܐ
ܛܥܘܢܐ ܘܐܝܟ ܗܠܐ ܒܒܦܘܠܛ

ܘܐܝܟ ܡܚܘܝܢܘܬܐ ܒܦܘܠܛ : ܦܘܪܫܢܐ ܒܝܢ ܟܗܪܒܐ ܕܚܕܐ ܢܘܩܙܬܐ ܕܐܠܗܐ ܠܬܢܝܢܐ ܕܛܥܘܢܐ ܟܘܠܗ ܚܕ ܟܘܠܘܡ ܡܢ ܚܕܐ ܢܘܩܙܐ ܠܐܚܪܢܐ ܟܪܒܬܐ ܕܥܒܕܐ ܟܘܠܗ ܚܕ ܓܘܠ.

ܥܡܠܐ (ܓܘܠ) = ܦܘܪܫܢܐ ܕܟܗܪܒܐ (ܒܦܘܠܛ) × ܛܥܘܢܐ ܡܟܗܪܒܢܐ (ܒܩܘܠܘܡ)

ܦܘܪܫܢܐ ܕܟܗܪܒܐ ܒܝܢ ܡܘܨܥܬܐ ܕܚܕܐ ܕܪܡܬܐ (٦ ܒܦܘܠܛ ܐܘ ١٢ ܒܦܘܠܛ) ܠܗܘܐ ܐܪܒܐ ܕܚܕܐ ܐܦ ܦܘܪܫܢܐ ܕܟܗܪܒܐ ܒܘܪܟܐ ܕܒܝܬܐ ܒܟܕܡ ٢٢٠ ܒܦܘܠܛ ܘܦܘܪܫܢܐ ܕܟܗܪܒܐ ܒܘܪܟܐ ܕܡܘܬܒܐ ܒܘܪܟܐ ܡܬܘܢܝܐ ܒܐܬܪܐ ܒܘܪܟܐ ܓܒܪܬܐ ܥܠ ܒܘܪܓܐ ܕܐܠܘܙܐ ܥܠܬܐ ܦܝܫ (٤٠٠) ܟܝܠܘܒܦܘܠܛ ܘܠܐܣܛܪܐ ܕܟܗܪܒܐ ܒܘܪܟܐ ܥܠ ܒܘܠܒܐ (ܐ) ܡܢ ܡܫܚܬܗ ܕܠܘܚܐ ܒܐܡܟܐ ܘܐܣܘܢܐ ܒܐܣܘܢܐ ܫܘܡܟܐ (ܛ ܠ) ܐܝܟ ܡܚܘܝܢܐ ܒܨܘܪܬܐ (٦ - ١٢) ܡܬܝܕܥܐ ܠܗ ܡܦܠܣܬܐ ܕܐܣܘܢܬܐ ($\text{ܒ}_{\text{ܐ}} = \text{ܩ} \frac{\text{ܛ ܠ}}{\text{ܡ}}$) ܒܕ (ܛ ܠ) ܐܣܘܢܐ ܕܠܘܚܐ ܗܢܐ ܘܒܝ ܐܣܘܢܐ ܡܬܠܒܢܬܐ ܠܓܒܠܐ ܒܘܪܟܐ ܘܒܘܕ ܕܐܗܐ ܒܗܘܐ.

$$\text{ܒ}_{\text{ܐ}} = \text{ܩ} \frac{\text{ܛ ܠ}}{\text{ܦ}}$$

$$\text{ܒ}_{\text{ܒ}} = \text{ܩ} \frac{\text{ܛ ܠ}}{\text{ܡ}}$$

ܨܘܪܬܐ (٦ — ١٢)

$$\text{ܒ}_{\text{ܐ}} \quad \text{ܒ}_{\text{ܒ}} = \text{ܩ}\,\text{ܛ ܠ} \left(\frac{١}{\text{ܦ}} - \frac{١}{\text{ܡ}} \right)$$

ܘܐܠܐ ܪܡܙܐ ܕܠܘܡܝܢܐ ܕܠܘܩܒܐ ܐܪܒܥܐ ܟܘܐ ܡܩܝܡܐ ܐܦ ܠܘܡܝܢܐ ܕܥܠ ܡܫܬܠܛܢܐ ܡܘܫܬܢܐ ܗܘ ܟܘܐ ܡܩܝܡܐ ܒܗܝ ܡܘܨܥܬܐ ܠܗ ܒܘܪܟܬܗ ܒܡܐ ܕܦܝܫ ܡܬܘܢܝܐ ܡܢܗ ܐܘ ܥܠܗ ܐܣܘܢܬܐ ܐܝܟ ܕܒܕܐ ܠܗ ܡܘܫܚܬܐ ܕܢܛܘܦܬܐ ܡܢ ܡܛܠܬܐ ܠܡܢܐ ܕܝܢܐ ܘܐܠܐ ܐܝܡ ܟܘܢܐ ܕܡܢܗ

ܒܗܕ ܕܐܗܐ ܗܘܐ ܦܘܪܫܢܐ ܒܝܢ ܚܘܡܢ̈ܐ ܒܟܠ ܢܩܘܕܬܐ ܘܡܢܝܢܐ ܕܐܪܥܐ ܒܗܠ ܠܚܘܡܢ̈ܐ ܕܗܘ ܢܩܘܕܬܐ ܘܟܘܐ (ܗܡ $\frac{\text{ܒ ܠ}}{\text{ܡ}}$) ܒܕ (ܒ ܠ) ܚܝܠܘܬܐ ܡܘܠܕܢܝܬܐ ܠܝܒܠܐ . (ܡ) ܚܘܟܪܐ ܕܢܩܘܕܬܐ ܡܢ ܚܝܠܘܬܐ (ܒ ܠ).

ܐܠܐ ܙܠܝܡܬܐ ܕܚܘܡܢ̈ܐ ܠܗ ܠܝܒܠܐ ܒܗܪܟܐ ܝܠܗ ܒܗܘܠܦܐ ܠܗ ܚܘܡܢ̈ܐ ܒܗܪܟܐ ܠܣܪܘܬܐ ܕܢܘܪܐ.

(٦ - ١٤) ܐܚܪܢܐ ܒܝܢ ܚܘܡܢ̈ܐ ܕܠܝܒܠܐ ܘܙܠܝܡܬܐ ܕܚܘܡܢ̈ܐ

ܡܢ ܚܘܐܠܝ ܒܐܚܪܢܐ (٦ - ١١)

$$\text{ܦܘܪܫܢܐ ܕܚܘܡܢ̈ܐ ܒ}_{\text{ܐܒ}} = \frac{\text{ܢܘܟܠܐ ܒܝܢ ܒ ܐ}}{\text{ܚܝܠܘܬܐ ܡܢܘܢܝܬܐ}}$$

$$\text{ܒ}_{\text{ܐܒ}} = \frac{\text{ܫ} \times \text{ܡ}}{\text{ܒ}_{\text{ܕ}}}$$

ܚܝܒܘܬܐ ܕܫܠܐ ܡܒܚܪܢܐ ܗܟܝܠ ܒܗܘ ܠܝܒܠܐ ܡܬܒܥܐ ܝܠܗ ܡܢ ܠܗ ܡܘܫܚܘܬܐ ܡܢ ܒܪܘܟܐ ܕܫܠܐ ܕܫܠܐ ܐܘ

$$\frac{\text{ܒ}_{\text{ܐܒ}}}{\text{ܡ}} = \frac{\text{ܫ}}{\text{ܒ}_{\text{ܕ}}}$$

(٦ - ٥) ܘܟܘܐ ܚܘܝܐ ܕܠܝܒܠܐ ܒܗܪܟܐ (ܠܗ)

ܘܚܘܝܠܐ $\frac{\text{ܒ}}{\text{ܡ}}$ ܦܝܫ ܡܪܐ ܙܠܝܡܬܐ ܕܚܘܡܢ̈ܐ . ܘܒܗܕ ܕܐܗܐ

ܚܘܝܐ ܕܠܝܒܠܐ = ܙܠܝܡܬܐ ܕܚܘܡܢ̈ܐ

$$\text{ܗܢܐ ܘܒܝܫ} \quad \frac{\text{ܒܘܠܛ}}{\text{ܡܝܬܪ}} = \frac{\text{ܢܘܛܢ}}{\text{ܟܘܠܘܡ}}$$

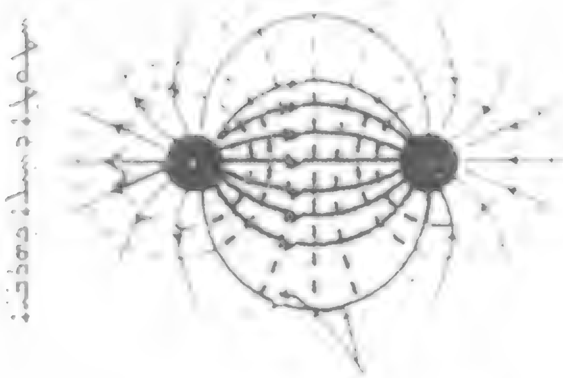
(٦ - ١٥) ܐܘܪܚܐ ܕܢܘܗܘܪ ܚܘܡܢ̈ܐ

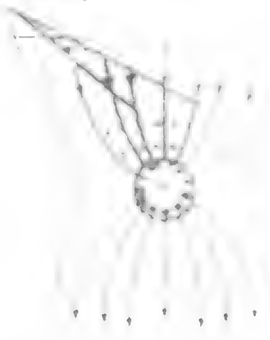
ܝܠܗ ܗܘ ܐܘܪܚܐ ܕܗܘܐ ܦܘܪܫܢܐ ܒܝܢ ܢܗܘܐ ܕܢܘܗܪܐ ܘ ܟܠܗ ܢܘܐ ܗܫܢܐ. ܘܟܠ ܐܘܪܚܐ ܡܬܚܙܝܢܐ ܚܝܠܐ ܘܡܬܚܙܐ ܝܠܗ ܐܘܪܚܐ ܢܘܗܪܐ ܕܚܘܡܢ̈ܐ ܒܕ ܠܝܗ. ܘܗܕܐ ܕܚܝܠܘܬܐ ܝܠܗ ܘܡܢ ܐܝܬܝܐ ܕܡܠܬܐ ܕܐܘܪܚܐ ܕܢܘܗܪ ܚܘܡܢ̈ܐ ܡܪܐ ܕܐܗܐ.

ܩܕܡܝܐ : ܠܐ ܡܬܦܓܥܝ ܣܪܛܐ ܥܡ ܚܕܕܐ

ܬܪܝܢܐ : ܣܛܘܦܐ ܕܚܝܠܐ ܚܫܡܠܝܐ ܗܘܝ ܥܡܘܕܝܐ ܥܠ ܣܛܘܚܐ ܕܫܘܝܘܬ ܚܝܠܐ

ܬܠܝܬܝܐ : ܡܢܝܢ ܣܛܘܚܐ ܕܫܘܝܘܬ ܚܝܠܐ ܕܒܝܢܬܝܗܘܢ ܠܐ ܦܢܝܐ ܕܗܘܐ ܠܗܘܢ ܚܝܠܐ ܕܒܚܕܐ ܡܕܡܝܐ ܒܥܘܕܐ ܐܝܟ ܙܒܢܐ ܣܪܘܛܐ ܕܣܛܘܦܐ ܕܚܝܠܐ ܡܕܡܝܐ ܐܝܟܢܐ ܕܒܗܝ ܡܢܝܢ ܣܛܘܚܐ ܕܫܘܝܘܬ ܚܝܠܐ ܡܬܚܙܝܢ ܕܒܐܬܪܐ ܫܢܝܐ ܕܚܘܪܐ ܒܚܕܐ ܘܫܢܝܐ ܘܐܣܟܡܐ (٦ . ١٣) ܡܘܩܦܐ ܡܢ ܕܡܝܐ ܣܛܘܚܐ ܕܫܘܝܘܬ ܚܝܠܐ ܠܚܘܪܐ ܦܪܝܫܐ ܕܐܣܟܡܐ ܒܚܕܐ ܘܫܢܝܐ







ܐܣܟܡܐ (٦ — ١٣)

ܬܘܦܣܐ (٦)

ܗܕܐ ܣܪܛܐ ܡܘܥܕܬܐ ܡܢ ܣܛܘܚܐ ܕܫܘܝܘܬ ܚܝܠܐ ܠܚܝܠܐ ܕܐܝܬ ܡܢܗ (١٠) ܒܚܠܐ ܘܚܝܠܐ ܕܐܚܪܢܐ (- ٣ ܒܚܠܐ) ܘܡܘܥܕܐ ܒܝܢܬܝܗܘܢ (٤) ܡܠܡܝܬܪܐ ܥܒܕ ܚܝܠܐ ܕܒܝܠܬܐ ܡܕܡܝܐ ܒܝܢܬܝܗܘܢ

ܫܪܵܝܵܐ :

$\text{ܒ ܐ} = ١٠ \text{ ܟܘܠܘܡ ، ܒ ܒ} = -٢ \text{ ܟܘܠܘܡ}$

$$\text{ܛܘ} = \frac{\text{ܒ}}{\text{ܡ}}$$

$$\text{ܛܘ} = \frac{\text{ܒ ܐܒ}}{\text{ܡ}} = \frac{\text{ܒ ܐ} - \text{ܒ ܒ}}{\text{ܡ}}$$

$$\text{ܛܘ} = \frac{١٠ - (-٢) \text{ ܟܘܠܘܡ}}{٤ \times ١٠^{-٣}} = \frac{١٢ \text{ ܟܘܠܘܡ}}{٤ \times ١٠^{-٣} \text{ ܡܒܕ}}$$

$$\text{ܛܘ} = ٣ \times ١٠^{٣} \frac{\text{ܟܘܠܘܡ}}{\text{ܡܒܕ}} \text{ ܐܘ } ٣ \times ١٠^{٣} \frac{\text{ܢܘܛܢ}}{\text{ܟܘܠܘܡ}} \text{ ܛܘܪܐ ܕܐܒܓܠܐ ܕܡܕܪܢܐ}$$

ܛܘܦܣܐ (٧)

ܢܘܩܙܬܐ (ܐ) ܫܩܠܐ (٥٠) ܗܡ ܡܢ ܡܢܛܪܐ ܕܛܘܒܐ ܚܫܝܠܐ ܚܫܘܒܬܗ (١ × ١٠ $^{-٣}$) ܡܚܕܪܟܘܠܘܡ ܘܢܘܩܙܬܐ (ܒ) ܫܩܠܐ (٩٠) ܡܢܟܬܒܐ ܡܢ ܡܢܛܪܐ ܕܐܝܟ ܠܘܕܐ ܨܘܪܬܐ (٦ ـ ١٤) ܚܫܘܒ ܚܝܠܐ ܢܝܫܢܐ ܠܬܪܬܐ ܕܚܫܘܒܬܐ ܚܘܠܡܐ (٢) ܡܚܕܪܟܘܠܘܡ ܡܢ ܢܘܩܙܬܐ (ܒ) ܠܢܘܩܙܬܐ (ܐ).

ܨܘܪܬܐ (٦ — ١٤)

ܫܪܵܝܵܐ

$$\text{ܒ} = \text{ܩܛ} \frac{\text{ܒ ܠ}}{\text{ܡ}}$$

$$\text{ܒ ܐ} = ٩ \times ١٠^{٩}\ \frac{\text{ܢܛ . ܡ}^{٢}}{\text{ܟܠ}^{٢}} \times \frac{١ \times ١٠^{-٣} \times ١٠^{-٦}\ \text{ܟܠ}}{٥٠ \times ١٠^{-٢}\ \text{ܡ}}$$

ܒ ܐ = ١٨ ܒܘܠܛ ܠܘܬ ܕܢܘܩܙܬܐ ܐ

$$\text{ܒ ܒ} = ٩ \times ١٠^{٩}\ \frac{\text{ܢܛ . ܡ}^{٢}}{\text{ܟܠ}^{٢}} \times \frac{١ \times ١٠^{-٣} \times ١٠^{-٦}\ \text{ܟܠ}}{٩٠ \times ١٠^{-٢}\ \text{ܡ}}$$

ܒ ܒ = ١٠ ܒܘܠܛ ܠܘܬ ܕܢܘܩܙܬܐ ܒ

ܦܘܪܫܢܐ ܒܝܢ ܠܘܬ ܕܡܫܪܘܝܐ ܢܘܩܙܐ ܐ . ܒ = ١٨ ܒܠ   ١٠ ܒܠ = ٨ ܒܠ.
(ܥܒܠ) = ܒ ܥ

ܥܘܒܕܐ = ٨ ܒܠ × ٢ × ١٠^-٦ ܟܘܠܘܡ = ١٦ × ١٠^-٦ ܓܘܠ ܥܘܒܕܐ
ܐܝܬܝܐ ܠܐܘܐ

ܡܘܦܩܐ (٨)

ܗܠܠܘ ܐܠܟܬܪܘܢ ܡܢ ܡܣܚܒܐ ܡܘܩܕܐ ܠܠܘܬ ܠܡܫܡܢܐ ܡܘܩܕܐ ܗܘܡܢ ܠܗ ܙܘܢܐ ܐܠܟܬܪܘܢܐ ܡܫܘܦܢܐ ܦܘܪܫܢܐ ܕܡܘܥܢܐ ܒܝܢ ܡܘܩܕܐ ܘ ٢٥٠ ܒܘܠܛ ܘܡܘܬܒܐ ܒܢܝܢܐ ٢٠٥ ܡܢܐ ܡܫܘܚܬܐ ܣܬܝܡ ܐܘܡܦܐ ܘܡܠܝܐ ܕܡܢܝܠܘ ܐܠܟܬܪܘܢ. ܒܪܦܦܐ ܕܠܗܦܟܘ ܒܠܢܘܪ، ܡܢ ܐܝܟܢ ܡܠܘܠܘܟܘ ܕܦܦܐ ܕܠܗܦܟܐ ܘܡܫܢܐ ܗܠܘ ܡܘܠܐ ܕܠܘܬ ܕܥܒܕܐ ܒܘܪܝܢܐ ܡܩܒܠܐ ܥܠܝܬܐ ܒܝܢ ܡܕܘܪܝ ܡܘܩܕܐ ܕܙܘܢܐ ܕܒܢܕܐ؟

ܐܢ ܡܝܬܠܘܬ ܕܡܘܬܐ ܕܐܠܟܬܪܘܢ = ٩٫١ × ١٠^-٣١ ܟܓܡ

ܘܡܘܥܢܐ ܕܐܠܟܬܪܘܢ = ١٫٦ × ١٠^-١٩ ܟܘܠܘܡ

ܫܪܝܐ

$$\text{ܦܘܪܫܢܐ ܕܠܘܬ} = \frac{\text{ܥܘܒܕܐ (ܐܘܡܦܐ)}}{\text{ܡܘܥܢܐ ܡܐܟܬܪܝܬܐ}}$$

ܐܘܡܦܐ ܡܢܐ = ܦܘܪܫܢܐ ܕܠܘܬ × ܡܘܥܢܐ ܡܐܟܬܪܝܬܐ

ܗܘܡܦܐ ܡܝܢܐ = ٢٥٠ ܦܠ × ١،٦ × ١٠^{-١٩} ܟܠ = ٤ × ١٠^{-١٧} ܓܘܠ

ܐܢܐ ܗܘ = $\frac{١}{٢}$ ܓ ܡ^٢ (ܡ = ܡܘܬܩܠܬܐ ܕܐܠܩܛܪܘܢ)

ܡ = $\sqrt{\frac{٢ \text{ ܗܘ}}{\text{ܓ}}}$ = $\sqrt{\frac{٢ \times 4 \times ١٠^{-١٧}}{٩،١ \times ١٠^{-٣١}}}$ = ٠،٩٣ × ١٠^٧ ܡ/ܪܦ

ܟܗܘ = $\frac{\text{ܒ}}{\text{ܡ}}$

= $\frac{٢٥٠ \text{ ܦܠ}}{٢،٥ \times ١٠^{-٢} \text{ ܡ}}$ = ١ × ١٠^٤ $\frac{\text{ܢܝܘܛܢ}}{\text{ܟܘܠܘܡ}}$ ܚܝܠܐ ܕܚܫܡܠܝܐ ܟܘܪܟܝܐ ܒܝܢ ܡܘܫܚܬܐ ܕܙܘܓܐ

ܡܬܠܐ (٩)

ܟܕ ܗܘ ܢܩܦܐ ܕܡܠܒܫ ܠܚܠܬܐ ܕܟܣܘܝܬܐ ܕܐܠܩܛܪܘܢ. ܐܡܠܠܗ ܢܛܘܦܬܐ ܕܙܝܬܐ ܠܠܘܚܐ ܕܟܣܘܝܬܐ ܡܘܡܪܗ (٤،٥٧ × ١٠^{-١٣}) ܢܝܘܛܢ. ܟܕ ܗܘ ܐܡܪ ܙܘܓܐ ܡܫܘܬܦܬܐ ܠܘܚܐ ܕܟܣܘܝܬܐ ܒܝܢܬܗܘܢ ܗܘܐ (٠،٥) ܣܢܛܝܡܛܪܐ ܘܚܝܠܐ ܕܚܫܡܠܝܐ ܟܘܪܟܝܐ ܒܝܢܬܗܘܢ ܗܘܐ ٢،٣٨ × ١٠^٥ ܟܡܐ ܐܝܬ ܟܘܠܐ

١) ܟܣܘܝܬܐ ܕܢܛܘܦܬܐ ܕܙܝܬܐ ܘܡܢܝܢܐ ܕܐܠܩܛܪܘܢܐ ܡܫܘܚܬܐ ܥܠܘܗ. ܐܢ ܒܟܠܗܝ ܕܟܣܘܝܬܐ ܕܐܠܩܛܪܘܢ = ١،٦ × ١٠^{-١٩} ܟܘܠܘܡ؟

٢) ܦܘܪܫܢܐ ܒܝܢ ܠܘܚܐ ܕܦܪܘܫ ܙܘܓܐ ܡܫܘܬܦܬܐ؟

ܫܪܝܐ

ܟܕ ܢܛܘܦܬܐ ܕܙܝܬܐ ܡܫܬܠܡܬܐ ܠܗ ܡܘܡܪܗ (ܡ) = ܚܝܠܐ ܚܫܡܠܝܐ (ܚ) ܕܡܠܚܡܐ ܚܝܠܐ ܚܫܡܠܝܐ ܥܠܗ ܐܝܟ ܨܘܪܬܐ (٦ - ١٥).

ܨܘܪܬܐ (٦ — ١٥)

$$ܫ = ٤٫٥٧ \times ١٠^{-١٣} \ \text{ܟܘܠܘܡ}$$

$$ܟܘܝ = \frac{ܫ}{ܚ\ ܕ}$$

$$ܚ\ ܕ = \frac{ܫ}{ܟܘܝ} = \frac{٤٫٥٧ \times ١٠^{-١٣}\ \text{ܟܘܠܘܡ}}{٢٫٣٨ \times ١٠^{٥}\ \text{ܟܘܠܘܡ} / \text{ܒܘܠܛ}}$$

$$= ١٫٩٢ \times ١٠^{١٨}\ \text{ܒܘܠܛ ܚܫܘܒܬܐ ܕܢܛܘܦܬܐ}$$

$$\text{ܡܢܝܢܐ ܕܐܠܩܛܪܘܢܐ} = \frac{\text{ܚܫܘܒܬܐ ܕܢܛܘܦܬܐ}}{\text{ܚܫܘܒܬܐ ܕܐܠܩܛܪܘܢ}}$$

$$= \frac{١٫٩٢ \times ١٠^{-١٨}\ \text{ܒܘܠܘܡ}}{١٫٦ \times ١٠^{-١٩}\ \text{ܒܘܠܘܡ}}$$

$$= ١٢\ \text{ܐܠܩܛܪܘܢܐ}$$

٢) ܐܠܨܬܐ ܕܟܘܝܐ = ܟܘܝܐ ܕܐܠܨܐ ܕܙܪܡܐ

$$ܟܘܝ = \frac{ܦ}{ܡ}$$

$$ܦ = ܟܘܝ \times ܡ = ٢٫٣٨ \times ١٠^{٨} \frac{\text{ܢܛ}}{\text{ܒܘܠܘܡ}} \times ٥٫٠ \times ١٠^{-٢} \times ٠٫٥ \times ١٠^{-٢}\ ܡ$$

$$= ١٫١٩ \times ١٠^{٣}\ \text{ܒܘܠܛ}$$

$$= ١٫١٩\ \text{ܟܝܠܘܒܘܠܛ ܦܘܪܫܢܐ ܒܝܢ ܠܘܚܐ ܕܡܕܘܟܢ ܐܠܨܬܐ}$$

(٦ ـ ١٦) ܦܫܝܛܘܬܐ ܕܙܪܡܐ

ܠܗ ܚܫܒܬܐ ܕܟܠ ܠܗܘܢ ܡܫܚܠܦܢܐ ܒܚܫܘܒܬܐ ܡܬܚܫܒܬܐ (ܝ) ܒܟܠܗܘܢ ܒܡܢܐ ܠܘܚܐ ܕܙܪܡܐ ܒܡܢܠܗ (ܝ) ܒܟܠܗ ܘܠܗ ܘܚܕܐ ܕܫܝܘܬܐ ܕܚܫܘܒܬܐ ܘܐܦ ܠܘܚܐ ܒܙܪܡܐ ܒܚܫܘܒܬܐ ܐܢܫܝܬܐ ܗܢܐ ܘܡܢ ܕܚܫܘܒܬܐ ܡܢ ܒܚܫܘܒܬܐ ܕܚܫܘܒܬܐ ܕܡܫܚܠܦܢܐ ܘܒܘܢܐ ܕܠܘܚܐ ܕܙܪܡܐ ܒܘܢܐ ܦܫܝܛܐ ܠܗ ܦܬܐ

ܡܕܝܬܐ ܒܡܦܩܢܘܬܐ ܕܥܕܢܝܬܐ ܕܐܗܐ ܡܡܠܝܢܐ ܘܡܢܘܗܝ ܒܠܘ ($\frac{\text{ܟܘܠܘܡ}}{\text{ܒܘܠܛ}}$)
ܘܦܝܫ ܡܕܝܬܐ ܦܪܕ.

$$\text{ܡܦܩܢܐ (ܡܦ)} = \frac{\text{ܟܡܝܘܬܐ (ܟ)}}{\text{ܠܘܚܡܐ (ܒ)}} \quad ...... (٦ — ٦)$$

ܘܦܝܫ ܡܘܢܕܝܐ ܦܪܕ ܕܐܝܠܗ ܡܦܩܢܐ ܕܡܡܠܝܢܐ ܕܦܐܫ ܡܬܛܥܢܐ ܥܠܘ ܟܡܝܘܬܐ ܕܡܢܠܗ ܚܕ ܟܘܠܘܡ ܒܗܘܐ ܠܘܚܡܐ ܕܥܕܢܐ ܚܕ ܒܘܠܛ.

ܛܘܦܣܐ (١٠)

ܚܫܘܒ ܡܦܩܢܐ ܕܥܕܢܝܬܐ ܕܛܘܦܣܐ ܒܡܝܐ ܐܢܐ ܬܠ ܦܠܓܐ ܕܡܛܪܐ ܕܐܗܐ ܛܘܦܣܐ.

$$\text{ܫܪܝܬܐ : ܕܒ ܒ} = \text{ܡܦ} \frac{\text{ܫ ܠ}}{\text{ܡ}} \qquad \text{ܡ} = \text{ܦܡ}$$

$$\text{ܒ ܠܘܚܐ} = \text{ܡܦ} \frac{\text{ܫ ܠ}}{\text{ܦܡ}}$$

$$\text{ܡܦ} = \frac{\text{ܫ}}{\text{ܒ}}$$

$$\text{ܡܦ} = \frac{\text{ܫ}}{\frac{\text{ܫ}}{\text{ܦܡ}}} = \frac{\text{ܦܡ}}{\text{ܡܦ}}$$

$$\text{ܡܦ} = \frac{\text{ܫ}}{\text{ܦܡ}}$$

ܘܕܒ ܡܦ = ܒܡܩܘܡܬܐ ܡܦܝܬܐ ܡܦ $\propto$ ܦܡ

ܡܢܘ ܐܗܐ ܛܘܦܣܐ ܕܝ. ܒܟܠ ܛܘܦܣܐ ܡܦܩܢܘܗܝ ܚܕ ܦܪܕ ܗܠܐ ܕܗܘܐ ܦܠܓܐ ܕܡܛܪܘܗܝ = ٩ × ١٠ ^٩^ ܡܛܪܐ ܘܐܗܐ ܥܠܐ ܡܢ ܦܠܓܐ ܕܡܛܪܐ ܕܐܪܥܐ !!! ܗܠܐ ܡܠܗ ܡܦܩܢܝܬܐ ܒܗܘ ܕܐܗܐ ܦܝܫ ܚܫܝܒܐ ܦܪܕ ܚܕܢܘܬܐ ܠܒܘܪܬܐ ܘܒܗܘ ܕܐܗܐ ܦܝܫܠܗ ܡܦܠܓܐ ܠܗ ܠܡܘܢܕܝܐ ܙܥܘܪܐ ܒܡܢܝܢܗ ܘܡܢܝܢܗ ܡܝܩܪܘܦܪܕ (ܡܝܦ) = ١٠ ^-٦^ ܘܦܝܩܘܦܪܕ (ܦܝܦ) = ١٠ ^-١٢^ ܦܪܕ

(٦ ـ ١٧) ܡܚܦܣܢܐ Capacitor

ܠܘ ܗܕܐ ܡܡܫܚܠܢܐ ܕܢܬܐܝܘ ܡܫܝܚܐ ܒܐܝܡܐ ܦܝܫ ܡܘܦܠܫܐ ܠܓܘܪܬܐ ܕܚܝܠܢܘܬܐ ܟܗܪܒܝܬܐ ܘܦܝܫ ܡܘܦܠܫܐ ܗܕܐ ܡܡܫܚܠܢܐ ܠܐܪܙܬܐ ܕܦܚܡܘܬܐ ܡܢ ܠܒܝ ܚܕ ܡܡܫܚܠܢܐ ܠܚܕܬܐ ܕܡܫܝܚܘܬܗ ܠܗ ܙܡܪܬܐ ܕܚܝܠܢܘܬܐ ܟܗܪܒܝܬܐ ܘܢܛܪܬܐ ܕܚܝܠܢܘܬܐ ܠܡܕܡܐ ܒܝ ܒܕܒܐ ܘܐܠܛܢܬܐ ܠܗ ܟܡܠܐ ܕܦܚܡܘܬܗ ܘܡܬܪܢܐ ܕܡܚܦܣܢܐ ܠܘ ܙܡܪܬܐ ܕܬܘܡܦܐ ܟܗܪܒܝܐ ܠܗ ܠܒܠܐ ܟܗܪܒܝܐ ܒܝܢ ܗܕܐ ܙܦܝܬܐ ܡܡܫܚܠܢܐ ܘܗܘܐ ܟܡܠܐ ܕܬܘܡܦܐ = $\frac{\text{ܒ ܢ}}{2}$ — $\frac{\text{ܒ}}{2}$ ܪܬܐ. ܦܘܪܫܢܐ

ܕܠܘܒܢܐ (ܦ) ܒܒܘܠܛ ܘܦܚܡܘܬܐ ܒܦܪܕ ܒܗܘܐ ܬܘܡܦܐ ܒܛܘܠ ܘܚܝܠܬܐ ܕܡܚܦܣܢܐ ܬܪܝܢ ܒܡܫܚܠܬܐ ܕܦܪܘܫܝ ܠܘܚܝܘ ܒܡܘܛܒܐ ܕܒܬܪܝ ܦܬ ܒܘܠܛܢܘܬܐ ܠܚܡܬܐ ܘܦܪܫܐ ܕܐܦܪܝ ܒܘܙܢܐ ܒܢܡܦܘܬܐ ܠܡܢܝܬܐ ܒܠ ܦܘܪܫܢܐ ܕܠܘܒܢܐ ܠܚܡܬܐ ܠܒܛܪܬܐ ܕܬܘܡܦܐ ܕܡܚܦܣܢܐ ܡܢ ܚܪܒܬܐ ܕܚܝܠܬܐ ܪܒܝܬܐ ܐܝܟ ܡܘܚܝܐ ܒܐܦܝܡܐ (٦ ـ ١٦) ܐܦ ܬܪܝܢ ܒܚܝܠܬܐ ܕܡܚܦܣܢܐ ܒܡܫܚܠܬܐ ܕܚܕ ܡܢ ܠܘܚܝ ܒܡܒܘܛܐ ܕܚܝܠܢܘܬܐ ܘܦܝܫ ܡܘܡܛܐ ܠܘܚܐ ܐܚܪܢܐ ܒܐܪܥܐ ܘܡܬܒܝܢ ܦܚܡܘܬܐ ܕܡܚܦܣܢܐ ܡܢ ܐܚܪܢܬܐ

$$ܡܦ = \frac{\text{ܒ}}{\text{ܦ}}$$

ܐܦܝܡܐ (٦ — ١٦)

ܟܕ (ܒ) ܚܝܠܢܘܬܐ ܕܠܚܝܕ ܡܢ ܗܪܘܝ ܠܘܚܐ. ܦ ܦܘܪܫܢܐ ܕܠܘܒܢܐ ܒܝܢ ܗܪܘܝ ܠܘܚܐ ܒܡܕ ܕܐܗܐ ܐܦ ܦܝܫ ܡܘܢܕܠܐ ܦܪܕ ܕܠܘ ܦܚܡܘܬܐ ܕܡܚܦܣܢܐ ܐܝܟ ܕܛܠܡ ܚܕ ܡܢ ܠܘܚܘ ܚܝܠܬܐ ܟܡܠܐ ܚܕ ܟܘܠܘܡ ܕܗܘܐ ܦܘܪܫܢܐ ܒܝܢ ܠܘܒܢܐ ܕܠܘܚܘ ܚܕ ܒܘܠܛ.

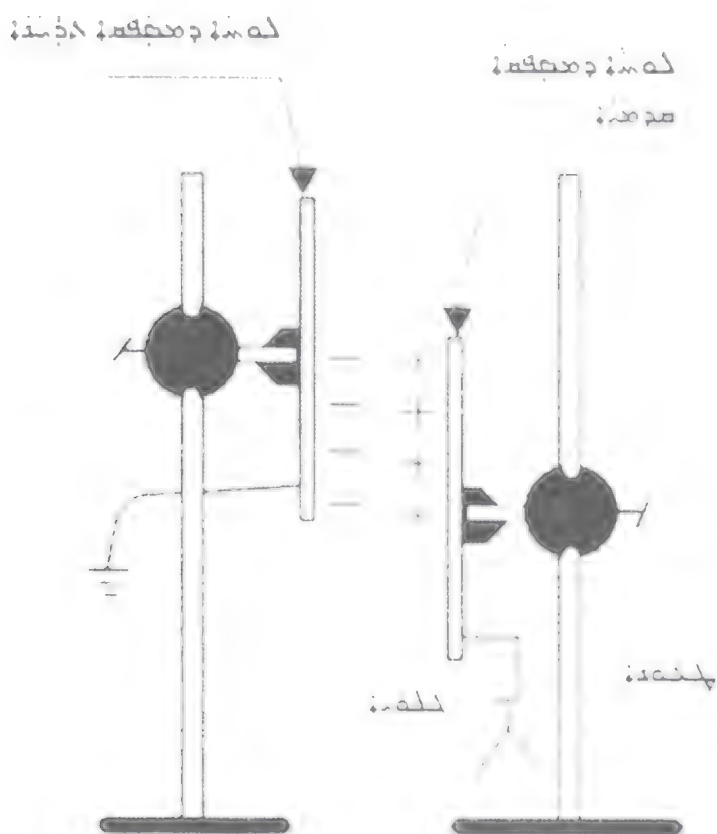
(٦ ـ ١٨) ܐܚܘܕܐ ܡܚܒܪܢܐ ܠܗ ܦܚܡܘܬܐ ܕܡܚܦܣܢܐ

ܟܠܐ ܦܚܡܘܬܐ ܕܡܚܦܣܢܐ ܥܠ ܗܘܝܡܐ ܡܫܪܐ ܘܐܘܒܠܐ ܕܡܚܦܣܢܐ ܒܗܘܕ ܕܐܗܐ ܐܚܘܕܐ ܡܚܒܪܢܐ ܥܠ ܟܡܠܐ ܕܡܚܦܣܢܐ ܠܘܗܝ

١ - ܛܥܝܢܘܬܐ ܟܗܪܘܒܠܝܬܐ ܕܠܘܚܐ ܕܡܣܦܩܢܐ

٢ - ܟܘܠܒܐ ܒܝܢ ܬܪܘܝܢ ܠܘܚܐ.

٣ - ܐܕܫܐ ܕܡܨܥܝܘܬܐ ܒܝܢ ܬܪܘܝܢ ܠܘܚܐ



ܨܘܪܬܐ (٦ — ١٧ ܐ)

ܘܥܠܠܬܐ ܕܡܕܒܪܢܘܬܐ ܕܐܝܢܐ ܡܟܘܪܐ ܥܠ ܡܣܦܩܢܘܬܐ ܕܡܣܦܩܢܐ ܦܝܫ ܡܘܦܠܚܐ ܒܘܣܡܐ ܡܘܚܘܝܐ ܒܨܘܪܬܐ (٦ - ١٧ ܐ) ܘܟܕ ܡܢ ܒܪ ܠܘܚܐ ܡܛܥܝܢܐ ܟܗܪܘܒܠܝܐ ܡܣܘܒܒܐ ܒܐܪܥܐ ܥܠܘܠܐ ܒܚܕ ܐܝܟܐ ܕܡܬܝܢܬܐ ܠܗ ܛܥܝܢܘܬܐ ܕܟܘܠܒܐ ܒܝܢ ܬܪܘܝܢ ܠܘܚܐ ܐܘ ܛܥܝܢܘܬܐ ܕܦܘܫܐ ܒܝܢ ܬܪܘܝܢ ܠܘܚܐ ܒܨܘܪܬܐ ܐܚܪܬܐ ܐܘ ܛܥܝܢܘܬܐ ܕܛܥܝܢܘܬܐ ܟܗܪܘܒܠܝܬܐ ܕܠܘܚܐ ܒܡܪܒܥܬܐ ܕܚܕ ܡܢ ܠܘܚܐ ܐܘ ܡܛܚܡܘܗ.

(١) ܛܥܝܢܘܬܐ ܟܗܪܘܒܠܝܬܐ ܐܘ ܡܬܘܬܒܬܐ ܕܒܝܢ ܬܪܘܝܢ ܠܘܚܐ ܕܡܣܦܩܢܐ:
ܗܘ ܛܝܒܘܬܐ ܕܡܣܦܩܢܐ ܐܚܝܕ ܒܬܪܘܝܢ ܘܪܫܐ ܕܐܠܦܐ ܘܐ. ܡܘܪܟܒ ܠܘܚܐ ܡܒܪܢܐ ܕܡܣܦܩܢܐ ܡܒܪܢܐ ܕܡܣܦܩܢܐ ܡܚܝܕܐ ܒܨܘܪܬܐ (٦ - ١٧ ܐ) ܠܟܠ ܒܨܘܪܬܐ ܕܐܠܦܝܢܐ ܡܫܠ ܘܝܕܥܐ ܛܥܝܢܘܬܐ ܡܬܘܬܒܬܐ ܕܒܝܢ ܬܪܘܝܢ ܠܘܚܐ ܕܡܣܦܩܢܐ ܦܝܫܐ ܣܘܝܬܐ ܒܡܕܪܬܐ ܕܐܚܝܬܐ ܕܐܠܦܐ ܗܝ ܕܡܚܘܐ ܥܠ ܒܡܕܪܬܐ ܕܒܘܥܝܐ ܕܗܝ ܠܘܚܐ ܐܦ ܗܕܝܘܬܐ ܕܛܥܝܢܘܬܗ ܘܗܘܐ ܗܘܟܠܘ ܝܠܗ ܘܝܕܥܬܐ ܕܡܣܦܩܢܘܬܐ ܕܡܣܦܩܢܐ ܒܘܝܕܬܐ ܕܛܥܝܢܘܬܐ ܕܠܘܚܘ ܟܗܪܘܒܠܝܐ ܒܗܝ $ܡܫ = \frac{ܛ}{ܦ}$ ܡܟܠ ܕܗܘܐ ܐܢܐ ܦܠܚܐ ܡܣܦܩܢܐ ܗܘ ܒܪܝܐ ܘܝܠܗ ܠܡܣܘܬܐ ܠܛܥܝܢܘܬܐ ܕܡܣܦܩܢܘܬܐ ܕܡܣܦܩܢܐ ܒܟܠܗܐ ܕܒܘܥܝܬܐ ܕܛܥܝܢܘܬܐ ܕܠܘܚܐ ܟܗܪܘܒܠܝܐ.

ܘܡܠܠܬܐ ܕܗܝ ܝܠܗ ܕܘܝܕܬܐ ܕܗܝ ܛܥܝܢܘܬܐ ܡܟܒܒܐ ܠܘܝܕܬܐ ܕܡܣܦܩܢܘܬܐ ܕܠܘܚܐ ܠܣܘܟܢܬܐ ܠܟܘܢܝܐ ܡܡܫܚܐ.

ܐ. ܦܬܠܘ ܬܪ̈ܝܢܐ ܡܫܦܐ
ܒܛܥܘܢܬܐ ܡܫܚܬܐ ܕܡܘܠܟ ܡܢ
ܦܪܘܫ ܠܘܚܐ ܠܒܝܠܐ ܒܡܕ̈ܪܟܐ ܐ.
ܡܘܙܕܠ ܒܛܥܘܢܬܐ ܡܬܘܦܦܐ ܡܢ
ܦܪܘܫ ܠܘܚܐ ܒܪܡܘܒܠܐ ܒܦܠܓܐ
ܐܗܐ ܒܛܥܘܢܬܐ ܥܠ ܒܛܥܘܢܬܐ ܒܝܕ
ܕܒܬܐ ܘܟܠܐܗܐ ܟܪܘܢܐ ܚܝܘܬܐ
ܕܛܥܘܢܬܐ ܥܠ ܦܪܘܫ ܠܘܚܐ ܘܟܪܘܢ
ܥܡܘܫ ܟܘܪ ܕܠܒܝܠܐ ܒܡܕ̈ܪܟܐ ܗܢܐ
ܘܕܝܢ ܟܪܘܢ ܦܘܕ̈ܪܢܐ ܕܟܘܒ̈ܢܐ
ܠܡܫܝܘܬ ܒܡܟܫܐ ܡܢ ܦܪܘܫ ܠܘܚܐ
ܒܗܝ ܕܐܗܐ ܙܕܐ ܡܫܘܬܐ ܒܗܢ ܡܨ = ܛ / ܦ

ܨܘܪܬܐ (٦ — ١٧ ب)

٢) ܒܡܟܫܐ ܡܢ ܦܪܘܫ ܠܘܚܐ :

ܐ. ܒܣܝܠ ܠܡܫܦܡܐ ܒܨܘܪܬܐ (٦ - ١٧ ب) ܒܛܥܘܢܬܐ ܡܫܚܬܐ ܕܫܒܬܐ ܕܘܕܡܐ ܕܠܠܘܐ ܡܫܘܢܐ ܥܠ ܘܦܝܬܐ ܕܦܘܕ̈ܪܢܐ ܕܟܘܒ̈ܢܐ ܡܫܚܬܐ ܡܢ ܠܘܚܐ ܕܡܫܦܡܐ ܘܫܒܬܐ ܕܘܕܡܐ ܕܠܠܘܐ ܒܘܠܐ ܥܠܘ ܠܟܘܒ̈ܢܐ ܕܠܘܚܐ ܡܕܡܝܐ ܐܠܐ ܒܟܘܒ̈ܢܐ ܕܠܘܚܐ ܗܕܢܐ ܗܘܐ ܡܫܦܡܐ ܠܡܛܝܬܘ ܒܕܪ̈ܓܐ ܘܡܟܝܠܐ ܕܡܫܪܒܬܐ ܕܡܢ ܡܢ ܦܪܘܫ ܠܘܚܐ ܡܢ ܐܚܪܝܢܐ ܒܣܘܣ ܒܡܘܪܬܐ ܕܫܒܬܐ ܕܘܕܡܐ ܕܠܠܘܐ ܡܢ ܕܡܫܘܐ ܥܠ ܒܡܘܪܬܐ ܕܟܘܒ̈ܢܐ ܕܠܘܚܐ ܡܕܡܝܐ ܕܡܫܦܡܐ ܘܐܗܐ ܗܘܟܠܘ ܥܠܘ ܘܝܕܥܐ ܕܡܫܘܬܐ ܕܡܫܦܡܐ ܟܡܐ ܕܟܪܘܢ ܒܡܟܫܐ ܡܢ ܦܪܘܫ ܠܘܚܐ ܒܗܢ.

ܡܨ = ܛ / ܦ

ܟܕ ܒܛܥܘܢܬܐ (ܛ) ܡܫܝܚܬܐ ܘܡܛܠ ܦܬܝܘܬܐ ܕܐܗܐ ܒܐܡܪܝܢ ܕܒܡܘܪܬܐ ܕܒܡܟܫܐ (ܡ) ܡܢ ܦܪܘܫ ܠܘܚܐ ܥܡ ܦܬܝܘܬܐ ܕܛܥܘܢܬܐ ܘܡܛܥܘܢܬܐ ܕܦܪܘܫ ܠܘܚܐ ܡܫܝܚܬܐ ܚܝܘܬܐ ܕܛܥܘܢܬܐ ܥܠ ܦܪܘܫ ܠܘܚܐ ܒܦܪ̈ܬܐ ܡܫܝܚܬܐ ܘܟܘܕ ܕܐܗܐ ܟܘܪ ܕܠܒܝܠܐ ܡܢ ܦܪܘܫ ܠܘܚܐ ܦܬ ܡܫܝܚܬܐ ܘܟܕ ܟܘܪ ܕܠܒܝܠܐ ܟܘܪ = ܦ / ܡ ܒܟܘܕ ܕܐܗܐ ܟܪܘܢ ܒܡܟܫܐ ܡܢ ܦܪܘܫ ܠܘܚܐ ܕܦܬ̈ܚܐ ܦܬܝܘܬܐ (ܦ / ܡ) ܡܫܝܚܬܐ ܘܟܘܕ ܕܐܗܐ ܙܕܐ ܡܫܘܬܐ ܕܡܫܦܡܐ ܠܘ ܡܫܪܒܬܐ ܕܦܪܘܫ ܠܘܚܐ.

٣) ܐܦ̈ܝܐ ܕܡܬܘܡܐ ܒܝܢ ܬܪܘܝܗ ܠܘܚ̈ܐ :

ܐ. ܒܫܒܝܠ ܡܦܩܢܐ ܒܨܘܪܬܐ (٦ - ١٧ ܒ، ܒܪܫܡܐ ܬܪܘܝܗ ܘܪܡܐ ܕܠܘܚܐ ܗ̇ܝ ܕܡܫܘܐ ܥܠ ܗܘܝܐ ܕܦܘܪ̈ܫܐ ܒܝܢ ܒܘܟ̈ܪܐ ܕܠܘܚܐ ܕܡܦܩܢܐ.

ܘܡܫܬܟܚܬܐ ܕܗܘܠܐ ܕܬܘܡܐ ܐܝܟ ܡܢܐ ܐܘ ܠܐ ܠܘܬܒܬܐ ܡܢ ܟܠ ܦܘܫܐ ܒܝܢ ܬܪܘܝܗ ܠܘܚܐ ܒܫܘܝܐ ܒܦܪܬܐ ܒܪܫܡܬܐ ܕܘܪܡܐ ܕܠܘܚܐ ܡܫܘܝܬܐ ܥܠ ܒܦܪܬܐ ܕܦܘܪ̈ܫܐ ܕܒܘܟ̈ܪܐ ܒܝܢ ܬܪܘܝܗ ܠܘܚܐ ܘܒܘܒ ܕܐܗܐ ܘܥܕܐ ܦܩܘܕܬܐ ܕܡܦܩܢܐ ܒܡܫܬܟܚܬܐ ܕܗܘܠܐ ܕܬܘܡܐ ܡܢ ܟܠ ܦܘܫܐ ܒܝܢ ܬܪܘܝܗ ܠܘܚܐ ܘܐܗܐ ܘܥܕܬܐ ܐܬܠܐ ܥܠ ܐܦ̈ܝܐ ܕܗܘܠܐ ܕܬܘܡܐ ܘܠܟܠܝܬܐ ܕܡܫܬܟܚܢܘܬܐ ܕܬܘܡܐ ܟܕ ܦܩܘܕܬܐ ܕܡܦܩܢܐ ܡܬܒܪܫ ܠܢܠܘܦܐ ܕܬܘܡܐ ܒܝܢ ܐܠܟܬܪܘܢ̈ܐ ܐܝܟܢܐ ܟܕ ܒܬܪܗ ܐܠܐ ܒܝܢ ܡܫܚܠܦܢܐ ܦܪܘܬܐ ܡܢ ܐܠܟܬܪܘܢ̈ܐ ܚܕܪܐ ܘܗܘܝ ܬܪܘܝܗ ܒܬܐܝܬ ܗܘܠܐ ܕܘܪ̈ܒܝܬ ܐܝܟ ܕܗܘܝ ܒܡܫܟܚܬܐ ܡܢ ܟܝܟܠܐ ܕܘܪ̈ܒܝܐ ܒܪ̈ܐ.

ܒ. ܦܫܛܘ ܡܬܦܠܛܢܐ ܟܝܟܠܐ ܕܘܪ̈ܒܝܐ ܥܠ ܡܢܕܐ ܕܬܘܡܐ ܒܫܠܦ ܡܙܘܠܐ ܕܐܠܟܬܪܘܢ̈ܐ ܚܕ ܢܘܗܪܐ ܐܘ ܒܫܠܒ ܐܠܟܬܪܘܢ̈ܐ ܡܙܘܠܐ ܒܬܘܡ̈ܢܐ.

ܘܒܬܪ ܐܢ ܒܥܝ ܡܬܠܬܘ ܕܫܘܝܬܐ ܠܠܘܦܐ (ܐܠܟܬܪܘܢ̈ܐ) ܥܠ ܡܬܠܬܘ ܕܫܘܝܬܐ ܦܫܛܐ (ܢܘܗܪܐ) ܗܢܐ ܘܡܢ ܡܬܠܝ ܒܬܪܐ ܐܝܟ ܡܫܘܚܬܐ ܒܨܘܪܬܐ (٦ - ١٨) ܘܟܕ ܟܝܟܠܐ ܕܘܪ̈ܒܝܐ ܟܠܬܪܐ ܡܢ ܠܬܘܡܐ ܒܝܬܘ (ܚܘܝ ܒ) ܗܦܟܐ ܠܟܝܟܠܐ ܒܪ̈ܐ ܐܠܐ ܒܝ ܚܘܪ ܡܢܘ ܒܬܘܒܢܐ ܒܗܝ ܡܢ̈ܝܐ ܕܫܘܝܬܐ ܡܬܠܬܐ ܒܝ ܚܘܪܐ ܐܠܘ ܡܢ ܫܘܝܬܐ ܡܫܬܟܚܢܐ (ܡܬܠܬܐ) ܕܡܥܒܪܐܠܝܘ ܟܝܟܠܐ ܒܪ̈ܐ (ܚܘܝ ܒ) ܒܝܢ ܬܪܘܝܗ ܠܘܚܐ ܒܗܘܒ ܕܐܗܐ ܚܘܝܐ ܕܟܝܟܠܐ ܕܘܪ̈ܒܝܐ (ܚܘܝ ܦ) ܟܕ ܬܘܡܐ ܒܝ ܬܦܘܪܐ ܐܠܘ ܡܢ ܚܘܝ ܕܟܝܟܠܐ ܒܪ̈ܐ (ܚܘܝ ܦ) ܒܗܘܒ ܕܐܗܐ ܒܝܪ ܦܘܠܛܐ ܕܚܘܝܐ ܕܟܝܟܠܐ.

ܗܢܐ ܡܢ ܚܘܝ = ܚܘܝ ܦ ܚܘܝ ܒ ܒܗܘܒ ܕܐܗܐ ܒܝܪ ܦܘܪ̈ܫܐ ܕܬܘܡ̈ܢܐ ܒܝܢ ܬܪܘܝܗ ܠܘܚܐ ܥܠ ܡܫܬܘܚܬܐ ܕܡܫܬܟܚܐ ܒܢܬܗ (ܚܘܝ × ܒ = ܦ) ܡܢ ܕܡܫܬܟܚ ܠܘܬܒܬܐ ܕܦܩܘܕܬܐ ܕܡܬܒܪܫܐ ܘܡܬܠ ܚܘܝܐ ܕܟܝܟܠܐ ܕܘܪ̈ܒܝܐ ܠܡܬܦܠܛܐ ܠܬܘܡܐ ܥܠ ܐܦ̈ܝܐ ܕܬܘܡܐ ܐܦ ܐܢ ܬܗܘܐ ܗܘܠܐ ܡܬܠܝܐ ܒܬܘܪܐ ܒܢܬܐ ܐܝܟ ܕܡܬܐ ܕܡܬܢܐ ܘܡܬܟܬܢܐ ܡܢܗ ܡܬܠܝ ܒܬܪܐܝܬܐ ܒܗܘܒ ܕܐܗܐ ܗܘܬܐ ܕܬܘܡܐ ܡܢ ܟܠ ܦܘܫܐ ܡܢܗ ܡܢ ܦܩܘܕܬܐ ܕܡܦܩܢܐ ܒܬܠܬܐ ܕܒܝܫܘܬܐ ܕܡܬܠܬܐ ܕܫܘܝܬܐ ܘܦܬܐ ܡܫܬܟܚܐ ܥܠ ܕܐܗܐ ܕܒܠܬܐ ܒܫܬܬܐ ܕܬܘܡܐ ܕܫܘܝܬܐ (ܚܬ ܦ) ܘܡܠܘ ܒܫܘܝܬܐ ܕܦܩܘܕܬܐ ܕܡܦܩܢܐ ܐܝܟ ܕܟܕܒ ܒܝܢ

ܡܪܘܝܗ ܠܘܬܗ ܒܡܘܬܐ ܘܡܫܩܘܠܝܬܐ ܕܡܫܩܦܐ ܒܝܬܗ ܐܝܟ ܕܦܪܝܫ ܒܝܢܬܗܘܢ
ܦܘܫܐ (ܐܘ ܡܦܩܘܢܐ ܚܠܝܠܐ).

ܚܝܠ

ܡܫܟܚܢܘܬܐ ܕܠܝܠܐ ܡܘܪܟܢܐ — ܠܐ ܡܫܟܚܢܘܬܐ ܕܠܝܠܐ ܡܘܪܟܢܐ

ܐܫܟܘܠܐ (٦ — ١٨)

ܡܫܩܘܠܝܬܐ ܕܡܫܩܦܐ ܦܕܪ ܟܕ ܠܘܬܗ ܒܡܘܬܐ (ܗܘ ܟ)

ܡܫܚܬܐ ܕܡܘܫܚܬܐ ܕܡܝܩܪܐ (ܗܘ ܟ) = ────────────

ܡܫܩܘܠܝܬܐ ܕܡܫܩܦܐ ܦܕܪ ܟܕ ܠܘܬܗ ܦܘܫܐ (ܗܘ ܟ)

ܘܠܗ ܡܫܘܚܬܐ ܡܫܚܬܐ ܡܢ ܚܕܘܬܐ.

ܘܐ· ܒܫܘܢܝܬܐ ܢܘܡܪܘܬܐ ܝܗܒ ܡܫܚܬܐ ܠܗ ܡܝܩܪܐ ܒܡܘܬܐ ܚܠܠܐ ܒܡܘܬܐ ܒܝܢܬܗܘܢ ܒܟܕ ܒܫܩܘܠܝܬܐ (ܗܘ ܟ) ܘܐܦ ܒܡܘܢܐ ܕܡܘܬܐ ܒܟܠ ܢܘܡܪܐ ܡܢ ܚܕܐ.

(٦ ـ ١٩) ܐܕܫܐ ܕܡܫܩܦܐ

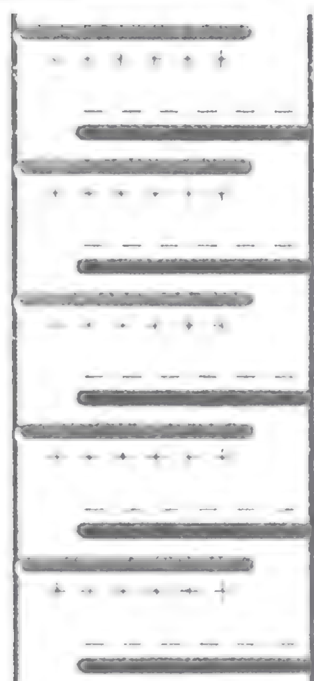
ܡܫܩܦܐ ܡܬܦܠܓܝܢ ܒܙܢܝܐ ܕܫܢܝܐ ، ܝܢܐ ܡܠܝ ܡܢܗ ܡܫܩܦܐ ܐܠܟܬܪܘܠܝܬܝܐ ܘܕܒܝܢ ܚܕܐ ܡܢ ܦܬܐ ܡܢ ܐܠܡܝܢܝܘܡ ܦܟ ܡܘܬܒܐ ܠܗܘ ܗܘܠܐ ܐܠܟܬܪܘܠܝܬܐ ܒܐܫܟܘܠܐ ܕܒܣܠܐ ܐܘ ܟܝܢܐ ܘܠܗܝܐ ܕܦܘܬܠܐ ܒܝܢ ܗܘܠܐ ܐܠܟܬܪܘܠܝܬܐ ܘܐܠܡܝܢܝܘܡ ܐܝܟ ܒܡܘܬܐ ܘܠܗ ܡܢ ܐܘܟܣܝܕ ܐܠܡܝܢܝܘܡ
ܘܐܝܬ ܐܦ ܡܫܩܦܐ ܦܕܝܪܐ ܦܟܝ ܡܢܐ ܒܟܡܐ ܒܡܘܬܐ ܡܘܬܒܐ ܟܕ ܠܘܬܗ ܐܝܟ ܡܫܩܦܐ ܕܦܘܫܐ ܘܡܫܩܦܐ ܕܒܡܠܐ ܘܡܫܩܦܐ ܕܡܝܟܐ ܘܡܫܩܦܐ ܕܚܨܦܐ.

ܦܝܫ ܡܬܦܠܚܐ ܒܓܘ ܓܝܠ ܢܘܫܢܐ ܟܢܪܐܝܬ ܡܫܦܥܢܐ ܡܫܚܠܦܐ ܕܫܦܥܘܬܐ ܘܒܓܘ ܓܝܬܐ ܕܠܒܝ. ܘܡܫܦܥܢܐ ܗܢ ܟܠܘܢܐ ܪܘܫܢܐ ܡܣܝܒܐ ܫܒܝܬܐ ܕܫܦܥܘܬܐ. ܘܟܕܘܢܝܐ ܗܕܝ ܐܕܫܐ ܡܢ ܡܫܦܥܢܐ ܫܒܝܬܐ ܕܫܦܥܘܬܐ ܘܡܫܦܥܢܐ ܡܫܚܠܦܐ ܕܫܦܥܘܬܐ.

ܡܫܦܥܢܐ ܫܒܝܬܐ ܕܫܦܥܘܬܐ :

ܗܠܘ ܡܫܦܥܢܐ ܗܢ ܕܡܫܘܬܐ ܡܬܘܬܦܬܐ ܘܟܠܘܢܐ ܫܒܝܬܐ ܘܗܘܐ ܬܘܟܠܐ ܬܡ ܟܕܘܡܝ ܠܘܚܐ ܫܒܝܬܐ ܘܬܘܟ ܕܐܗܐ ܫܦܥܘܬܐ ܗܘܐ ܫܒܝܬܐ ܐܝܟ ܡܫܦܥܢܐ ܕܦܢܝ ܟܘܪܝܐ ܡܢ ܕܡܢܐ ܣܦܪܐ ܘܦܪܝ ܬܝܒܘܬܝ ܗܘܠܐ ܟܠܘܢܐ ܘܦܢܝ ܠܦܐ ܐܝܟ ܠܘܚܐ ܒܗ ܟܠܘܢܐ ܡܢ ܡܘܬܒܐ ܒܗ ܟܢܐ.

ܡܫܦܥܢܐ ܡܫܚܠܦܐ ܕܫܦܥܘܬܐ:



ܐܣܟܡܐ ٦ — ١٩ ܡܫܦܥܢܐ

ܘܗܕܝ ܐܗܐ ܡܫܦܥܢܐ ܡܢ ܠܘܚܐ ܣܦܪܝܐ ܡܘܝܠܢܐ ܬܟܒܝ ܒܗ ܠܘܚܐ ܐܣܪܢܐ ܫܒܝܬܐ ܘܟܬܝܒܐ ܡܢܝܗ ܘܬܪܝܢܐ ܕܗܘܝ ܐܝܢܐ ܠܘܚܐ ܡܘܝܠܢܐ ܟܬܝܒܐ ܡܢ ܠܘܚܐ ܫܒܝܬܐ ܬܢܕ ܦܘܫܐ ܘܐܗܐ ܡܫܦܥܢܐ ܗܢ ܒܓܪܐ ܒܟܘܪܐ ܗܠܘ ܘܠܘܚܐ ܪܚܝܩܐ ܗܠܝܗ ܡܢ ܚܕܪܐ ܦܫܝܛܐ ܐܘ ܬܪܝܢܐ ܕܗܘܝ ܟܬܝܒܐ ܬܢܕ ܠܘܚܐ ܪܚܝܩܐ ܡܢ ܚܕܪܐ ܘܐܗܐ ܡܫܦܥܢܐ ܗܢ ܒܓܪܐ، ܒܟܘܪܐ ܗܠܘ ܪܬܢܐ ܘܠܘܚܐ ܡܪܝܒܐ ܪܬܢܐ ܡܢ ܚܕܪܐ ܘܗܒܝܘ ܦܢܝ ܬܘܒܪܐ ܒܗܘ ܟܢܫܐ ܕܠܬܢܐ ܠܬܘܒܪܬܗ ܡܢ ܡܟܬܒܢܘܬܐ ܬܪܒܐ.

ܘܦܢܝ ܡܬܦܠܚܐܝܬ ܡܫܦܥܢܐ ܒܗ ܕܘܪܫܐ ܕ ܙܠܠܬܐ (Tuning) ܒܗ ܦܪܣܘܡܐ ܟܢܪܝܬ.

ܘܐܣܟܡܐ (٦ ـ ١٩) ܒܚܙܝ ܡܫܦܥܢܐ ܡܫܚܠܦܐ ܕܫܦܥܘܬܐ.

(٦ ـ ٢٠) ܐܘܪܚܬܐ ܕܐܣܪܬܐ ܕܡܫܦܥܢܐ

ܦܢܝ ܐܣܝܪܐ ܡܫܦܥܢܐ ܠܦܘܬ ܫܝܡܘܬܐ ܒܠܚܘܕ ܒܗ ܕܘܪܫܬܐ ܕܡܪܬܝܢܐ ܘܐܘܪܚܬܐ ܕܐܣܪܬܗܘܢ ܒܠܚܘܕ :

ܐ) ܐܣܪܬܐ ܒܢܩܦܘܬܐ .

ܒ) ܐܣܪܬܐ ܒܫܘܝܘܬܐ.

ܐ) ܐܣܕܪܐ ܕܡܣܦܣܢܐ ܒܢܩܝܦܘܬܐ

ܗܕܐ ܒܢܘܟܠܐ ܕܢܩܝܦܘܬܐ ܡܢ ܡܣܦܣܢܐ (ܣܦ١ ، ܣܦ٢ ، ܣܦ٣) ܐܝܟ ܡܘܚܘܝܐ ܒܨܘܪܬܐ (٦ ـ ٢٠) ܘܡܣܦܣܢܐ (ܣܦ١) ܕܩܝܛ ܚܝܠܐ ܠܗܘܢ ܡܕܡܐ ܒܚܫܘܠܬܐ ܩܘܡܬܐ ܡܢ ܡܟܘܢܐ ܘܠܐܕܝ ܠܗܘܢ ܒܢܘܟܠܐ ܘܚܝܠܘ ܒܚܫܘܠܬܐ ܠܠܘܚܐ ܘܒܐܗܐ ܚܝܢ ܠܗܝ ܡܕܡܐ ܡܢ ܡܣܦܣܢܐ ܗܕܐܢܐ ܒܚܫܘܠܬܐ ܩܘܡܬܐ ܘܗܟܢܐ ܚܝܠ ܦܨܝܐ ܕܠܗܝ ܕܡܣܦܣܢܐ ܒܠܕܘܟܐ ܘܒܗܘܢ ܕܐܗ ܘܗܝ ܐܗܐ ܚܝܠܐ ܒܠܚܕܕܐ ܡܢ ܚܕ ܠܗܝ ܕܡܣܦܣܢܐ ܗܝ ܠܗܝ ܐܚܪܢܐ ܡܢ ܡܣܦܣܢܐ ܚܒܪܐ ܗܝ ܕܚܒܡ ܐܢܐ ܡܣܦܣܢܐ ܦܠܝܢ ܒܗܠܐ ܒܢܬܗ ܡܢ ܚܫܘܠܬܐ ܒܟܠܬܐ ܕܠܕܘܟܐ ܘܚܫܘܠܬܐ ܕܟܠܝܕܐ ܡܢܗ ܚܘܝ ܚܫܘܠܬܐ ܕܡܣܦܣܢܐ ܠܗܡܟܠܬܐ.

ܨܘܪܬܐ (٦ — ٢٠)

ܐܝܬܝܗܝܢ ܕܒܠܝܬܐ ܕܗܐ ܐܣܕܪܐ ܒܠܝܗ :

١) ܚܫܘܠܬܐ ܠܗܡܟܠܬܐ (ܚܫܘܠܬܐ ܟܠܢܝܬܐ ܕܚܘܫܒܬܐ) = ܚܫܘܠܬܐ ܕܟܠܚܕ ܡܣܦܣܢܐ ܡܢ ܡܣܦܣܢܐ ܕܢܩܝܦܘܬܐ.

ܗܢܐ ܘܕܝܢ (ܚܫܘܠܬܐ ܟܠܢܝܬܐ ܕܚܘܫܒܬܐ) = ܚ = ܚ١ = ܚ٢ = ܚ٣ ... ܘܒܕܪܟܐ

٢) ܦܘܪܫܢܐ ܕܚܘܒܢܐ ܟܠܢܝܐ = ܚܘܒܢܐ ܕܦܘܪܫܢܐ ܕܚܘܒܢܐ ܕܡܣܦܣܢܐ ܕܢܩܝܦܘܬܐ

ܗܢܐ ܘܕܝܢ ܦ = ܦ١ + ܦ٢ + ܦ٣ ... ܘܒܕܪܟܐ.

٣) ܡܠܝܢܐ ܕܣܦܝܩܘܬܐ ܠܗܡܟܠܬܐ ܗܘܐ ܚܘܒܢܐ ܕܡܠܝܢܐ ܕܣܦܝܩܘܬܐ ܕܡܣܦܣܢܐ ܢܩܝܦܐ ܗܢܐ ܘܕܝܢ

$$\frac{١}{\text{ܡܣ}} = \frac{١}{\text{ܡܣ}١} + \frac{١}{\text{ܡܣ}٢} + \frac{١}{\text{ܡܣ}٣} \ldots \text{ܘܒܕܪܟܐ} \qquad (٦ — ٧)$$

ܘܠܚܝܠܬܐ ܕܐܚܝܘܬܐ ܐܚܪܬܐ ܒܗܕܟܝܢ ܗܝ ܕܐܬܐ

ܟܕ ܦ = ܦ١ + ܦ٢ + ܦ٣ ... ܢܛܪܬܐ ܕܗܘܦܟܐ

ܘܟܕ ܦ = $\frac{ܒ}{ܡܫ}$ ܐܝܟ ܒ ܝܠܗ ܟܡܝܘܬܐ ܛܘܢܐ ܠܟܠܗ ܡܣܦܩܢܐ

$$\frac{ܒ}{ܡܫ} = \frac{ܒ_{١}}{ܡܫ_{١}} + \frac{ܒ_{٢}}{ܡܫ_{٢}} + \frac{ܒ_{٣}}{ܡܫ_{٣}}$$ ܘܗܟܢܐ

ܘܟܕ $ܒ = ܒ_{١} = ܒ_{٢} = ܒ_{٣}$

$$\frac{١}{ܡܫ} = \frac{١}{ܡܫ_{١}} + \frac{١}{ܡܫ_{٢}} + \frac{١}{ܡܫ_{٣}} \ldots$$ ܘܗܟܢܐ

ܟܕ ܡܚܫ ܦܘܫܢܐ ܥܡܘܕܐ ܠܘܡܕܠܝܬܐ ܕܟܘܪܟܝܬܐ ܕܡܣܦܩܢܐ ܐܣܝܪܐ ܒܢܝܫܘܬܐ ܘܦܬܐ ܡܘܙܕܝܢܐ ܥܡܘܕܐ ܠܘܡܕܠܝܬܐ :

ܕܝܠܗ ܥܡܘܕܐ ܕܡܣܦܩܢܐ ܕܐ. ܦܬܝܠܗ ܒܘܚܠܦܬܐ ܓܘ ܟܘܪܟܝܬܐ ܕܡܣܦܩܢܐ ܐܣܝܪܐ ܒܢܝܫܘܬܐ ܒܦܪܕܐ ܟܡܝܘܬܐ ܒܝܕܗ ܡܢ ܒܝܘܬܐ ܕܠܐ ܒܘܚܠܦܐ ܒܦܘܪܫܢܐ ܕܟܘܒܢܐ.

ܘܡܢ ܚܘܝܬܐ ܕܐܚܝܘܬܐ ܐܚܪܬܐ ܒܦܠܛܚ ܡܢܘܬܢܝܗ ܕܥܡܘܕܐ ܠܘܡܕܠܝܬܐ ܠܟܘܪܟܝܬܐ ܕܡܣܦܩܢܐ ܐܣܝܪܐ ܒܢܝܫܘܬܐ ܒܝ ܝܟܘܪܬܐ ܝܠܗ ܡܢ ܥܡܘܕܐ ܕܡܣܦܩܢܐ ܕܟܘܪܟܝܬܐ ܢܝܫܬܐ.

ܒ) ܐܣܪܬܐ ܕܡܣܦܩܢܐ ܒܫܘܝܘܬܐ:

ܬܪܬܝܢ ܟܘܪܟܝܬܐ ܥܒܘܕܝܬܐ ܐܝ. ܦܬܝܠܗ ܐܣܝܪܐ ܚܕ ܠܘܬ ܡܢ ܟܠ ܡܣܦܩܢܐ ܒܡܛܠܬܐ ܡܢܘܬܦܐ ܘܦܬܝܠܗ ܐܣܝܪܐ ܠܘܬ ܐܚܪܢܐ ܒܡܛܠܬܐ ܐܚܪܬܐ ܡܢܘܬܦܐ ܐܝܟ ܒܐܣܟܡܐ (٦ ـ ٢١) ܦܬܝܠܗ ܡܕܝܬܐ ܐܗܐ ܐܣܪܬܐ ܒܐܣܪܬܐ ܕܫܘܝܘܬܐ.

ܒܘܕ ܕܐܗܐ ܒܗܘܐ ܠܟܠܝܗ ܡܣܦܩܢܐ ܒܐܗܐ ܐܢܫܘܬܐ ܦܘܪܫܢܐ ܕܟܘܒܢܐ ܒܝܢܗ ܘܝܠܗ ܦܘܪܫܢܐ ܕܟܘܒܢܐ ܕܡܘܟܐ ܒܪܢܐ ܕܦܬܝܠܗ ܡܘܡܛܝܐ ܒܡܫܛܒܗ ܥܘܦܐ ܕܟܘܪܟܝܬܐ ܒܘܕ ܕܐܗܐ ܐܢܫܝܐ ܕܐܗܐ ܐܣܪܬܐ .

ܡܫ١
ܡܫ٢
ܡܫ٣
ܦ

ܐܣܟܡܐ (٦ ـ ٢١)

١) ܦܘܪܫܢܐ ܕܙܘܪܡܐ ܟܠܢܝܐ = ܦܘܪܫܢܐ ܕܙܘܪܡܐ ܕܟܠ ܡܩܘܡܐ ܒܡܘܙܠܬܐ ܡܫܘܚܬܐ ܗܘܐ ܘܕܝܢ ܦ = ܦ١ = ܦ٢ = ܦ٣ ... ܘܗܟܢܐ

٢) ܚܘܝܠܐ ܟܠܢܝܐ ܕܡܘܙܠܬܐ = ܟܢܫܐ ܕܚܘܝܠܐ ܕܙܪܡܐ ܒܡܠܬܐ ܡܩܘܡܐ ܡܫܘܚܐ.

ܚ = ܚ١ + ܚ٢ + ܚ٣ .... ܘܗܟܢܐ

٣) ܡܩܘܡܬܐ ܟܠܢܝܬܐ ܕܡܘܙܠܬܐ ܕܡܩܘܡܐ ܐܝܟܐ ܒܟܢܘܫܬܐ ܚܕܐ ܟܢܫܐ ܕܐܝܟ ܡܩܘܡܐ.

ܡܩ = ܡܩ١ + ܡܩ٢ + ܡܩ٣ ... ܗܟܢܐ

ܘܠܚܘܝܬܐ ܕܐܝܠܝܬܐ ܠܚܘܕܬܐ ܗܟܝܠ ܡܢ ܕܐܬܐ :

ܒܕ ܚ = ܚ١ + ܚ٢ + ܚ٣ ... ܗܟܢܐ

ܒܕ ܚ = ܦ ܡܩ

ܦ ܡܩ = ܦ١ ܡܩ١ + ܦ٢ ܡܩ٢ + ܦ٣ ܡܩ٣ ... ܗܟܢܐ

ܡܩ = ܡܩ١ + ܡܩ٢ + ܡܩ٣ ... ܗܟܢܐ .....(٦ — ٨)

ܘܡܢ ܚܝܬܐ ܕܐܝܠܝܬܐ (٦ - ٨) ܒܩܠܝܠܐ ܡܬܚܙܝܐ ܕܡܩܘܡܬܐ ܟܠܢܝܬܐ ܠܡܘܙܠܬܐ ܕܡܩܘܡܐ ܡܫܘܚܐ ܕܐܝܬܝܗ ܒܪ ܪܒܐ ܡܢ ܟܠ ܡܩܘܡܬܐ ܕܟܠܚܕܐ ܡܩܘܡܐ ܒܗ ܡܘܙܠܬܐ ܡܫܘܚܬܐ ܒܕ ܐܝܕܐ ܡܩܘܡܬܐ ܟܠܢܝܬܐ ܒܐܝܠܝܬܐ ܕܐܝܬܝܗ ܡܫܘܚܬܐ ܒܟܠܗܐ ܕܐܢܫܘܬܐ ܡܬܘܦܩܐ ܕܠܘܚܐ ܒܪܘܒܠܐ.

ܠܘܦܬܐ (١١)

ܡܩܘܡܐ ܡܢ ܗܕܐ ܠܘܚܐ ܒܘܪܐ ܡܫܘܚܐ ܡܩܘܡܬܗ ٥ ܐܘܡܦܪܐ ܦܠܝܗ ܡܘܡܛܝܐ ܒܚܕܐ ܚܝܠܗ ܕܘܠܛܐ ܒܡܫܬܐ ٢٠٠ ܒܥܠܡܐ ܐܝܟܢ ܡܢ ܕܐܬܐ.

١ . ܚܘܝܬܐ ܕܒܕ ܐܬܪܐ ܥܠ ܐܝܟܘ ܠܘܚܐ ܕܡܩܘܡܐ.

٢ . ܐ. ܦܠܝܗ ܡܘܡܟܪܐ ܡܢ ܐܝܟܘ ܠܘܚܐ ܕܡܩܘܡܐ ܘܟܠܐ ܐܘܡܦܐ ܒܐܘܡܦܘ ٢ ܘܫܠܐܠܗ ܠܐܝܢܘܬܐ ܡܢ ܐܝܟܘ ܠܘܚܐ ܒܡܐ ܒܟܬܐ ܚܘܝܬܐ ؟

٣ . ܐ. ܡܛܠܠܗ ܡܘܡܛܐ ܡܢ ܐܝܟܘ ܠܘܚܐ ܕܡܩܘܡܐ ܘܡܩܘܡܬܐ ܒܗܕ ܕܐܘܐ ܦܠܝܗ ܡܘܡܛܐ ܒܗܘܡܐ ܒܡܐ ܒܟܬܐ ܚܘܝܬܐ ܘܒܡܐ ܒܟܬ ܦܘܪܫܢܐ ܕܙܘܪܡܐ ܡܢ ܠܘܚܐ ܕܡܩܘܡܐ؟

ܫܪ̈ܝܐ

(١) ܫ = ܩܘ ܦ = ٥ × ٢٠٠ = ١٠٠٠ ܢܝܘܛܘܦܕܐ

(٢) ܩܘ ܠ = ܩܚ ܓ ܩܘ ܦ = ٢ × ٥ = ١٠ ܢܝܘܛܘܦܕܐ

ܫ = ܩܘ ܓ ܦ

ܫ = ܩܘ ܓ ܦ = ١٠ × ٢٠٠ = ٢٠٠٠ ܢܝܘܛܘܢܓܘܠ

(٣) ܫܘܠܚܢܐ ܕܦܠ̈ܚܐ ܡܫܠܡܢܐ ܕܡܫܠܛܢܐ ܕܩܘܝܡܐ ܕܡܣܘܪ̈ܒܐ ܘܐܠܗ ܫܘܠܚܢܐ ٢٠٠٠ ܢܝܘܛܘܢܓܘܠ ܘܡܬܚܫܒ ܚܕܢܐ = ٥ ܢܝܘܛܘܦܕܐ ܒܚܕ ܡܫܘܚܬܐ ܕܚܝܠܐ ܘܕܡܢܝܢܐ ܕܦܘܠܚܢܐ.

$$ܦ = \frac{ܫ}{ܙܢ} = \frac{٢٠٠٠}{٥} = ٤٠٠ \text{ ܘܐܛ}$$

ܦܘܫܩܐ (١٢)

ܡܫܘܚܬܐ ܡܬܡܢܝܐ ٢ ܢܝܘܛܘܦܕܐ ܘܫܘܠܚܢܐ ١٠٠ ܢܝܘܛܘܢܓܘܠܐ ܘܡܬܚܫܒܐ ܒܝܬ ܦܪܫܘܬ ܠܚܝܠ ٠،٥ ܡܢ ܚܕܐ ܐܝܟ ܕܡܬܐ ܕܝܠܝܕܐ ܕܩܪ̈ܒܐ ܒܝܬ ܠܚܝܠ.

ܫܪ̈ܝܐ :

$$ܦ = \frac{ܫ}{ܙܢ} = \frac{١٠٠}{٢} = ٥٠ \text{ ܘܐܛ}$$

$$ܠܚܝ = \frac{ܦ}{ܓ} = \frac{٥٠}{٠،٥ \times ١٠^{-٢}} = ١٠٠٠٠ \frac{ܕܠ}{ܚܠ}$$

ܬܘܦܣܐ (١٣)

ܦܬܝܠܗ ܐܡܝܪܐ ܗܕܐ ܡܥܦܢܐ (٦) ܡܝܩܪܘܦܪܕ ، (٣) ܡܝܩܪܘܦܪܕ ܒܢܝܫܘܬܐ ܘܦܬܝܠܗ ܒܣܝܢܬܐ ܒܢܘܟܬܐ ܒܟܚܘܢܬܐ (٢٠٠) ܡܝܩܪܘܟܘܠܘܡ ܚܫܘܒ :

١) ܦܘܪܥܢܐ ܕܟܘܒܢܐ ܡܟܝܢܐ.

٢) ܟܣܘܢܬܐ ܕܟܠ ܡܥܦܢܐ.

٣) ܦܘܪܥܢܐ ܕܟܘܒܢܐ ܕܟܠ ܡܥܦܢܐ.

٤) ܚܝܠܐ ܕܚܘܪܥܢܐ ܓܢܝܙܐ ܒܟܠ ܡܥܦܢܐ.

٥) ܚܝܠܐ ܕܚܘܪܥܢܐ ܓܢܝܙܐ ܓܘ ܒܢܘܟܬܐ.

ܫܪܝܐ :

ܐܝܟ ܡܚܘܝܢܐ ܒܨܘܪܬܐ (٦ ـ ٢٢)

$$١)\quad \frac{١}{\text{ܡܣ}} = \frac{١}{\text{ܡܣ}_{١}} + \frac{١}{\text{ܡܣ}_{٢}}$$

$$\frac{١}{\text{ܡܣ}} = \frac{١}{٦} + \frac{١}{٣}$$

ܨܘܪܬܐ (٦ ـ ٢٢)

ܡܣ = ٢ ܡܟܦ ܡܥܦܢܐ ܠܘܡܟܠܢܐ ܠܒܢܘܟܬܐ.

$$\text{ܦ} = \frac{\text{ܟ}}{\text{ܡܣ}}$$

$$\text{ܦ} = \frac{٢٠٠ \text{ ܡܟܠ}}{٢ \text{ ܡܟܦ}} = ١٠٠ \text{ ܟܠ ܦܘܪܥܢܐ ܕܟܘܒܢܐ ܕܫܘܝܐ}$$

٢) ܐܫܪܬܐ ܒܢܝܫܘܬܐ

$\text{ܟ}_{١} = \text{ܟ}_{٢} = \text{ܟ} = ٢٠٠$ ܡܟܠ

$$٣)\quad \text{ܦ}_{١} = \frac{\text{ܟ}_{١}}{\text{ܡܣ}_{١}} = \frac{٢٠٠}{٦} = \frac{١٠٠}{٣} \text{ ܟܠ}$$

$$ܦ٢ = \frac{ܟ٢}{ܡܣ٢} = \frac{٢٠٠}{٣}\ ܒܠ$$

$$ܛܩ١ = \frac{١}{٢}\ ܦ١\ ܟ١ = \frac{١}{٢} \times \frac{١٠٠}{٣} \times ٢٠٠ \times ١٠^{-٦}$$

٤) $$ܛܩ١ = \frac{١٠^{-٣}}{٣}\ ܓ̰ܘܠ$$

$$ܛܩ٢ = \frac{١}{٢}\ ܦ٢\ ܟ٢ = \frac{١}{٢} \times \frac{٢٠٠}{٣} \times ٢٠٠ \times ١٠^{-٦}$$

$$ܛܩ٢ = \frac{٢ \times ١٠^{-٣}}{٣}\ ܓ̰ܘܠ$$

٥) ܛܩ = ١٠ ٢ = ٠٫٠٠١ ܓ̰ܘܠ ܛܘܩܦܐ ܟܠܢܝܐ ܕܐܝܬ ܓ̰ܗ ܒܡܘܟܬܐ

$$ܘܐ\ ܛܩ = ܛܩ١ + ܛܩ٢ = \frac{١٠^{-٣}}{٣} + \frac{٢ \times ١٠^{-٣}}{٣} = ٠٫٠٠١\ ܓ̰ܘܠ$$

ܬܘܪܓܡܐ (١٤)

ܡܫܘܫܐ ܡܫܘܚܬܗ (١٢) ܡܝܟܪܘܦܐܪܕ ܚܕܐ ܠܩܘܕܪܐ ܕܟܘܪܝܐ ܕܟܝܠܗ ٦٠ ، ܒܐܠܚ ܦܬܠܗ ܡܘܡܚܐ ܒܡܫܘܚܬܐ ܒܡܫܘܫܐ ܐܚܪܢܐ ܡܫܘܚܬܗ (٨) ܡܝܟܪܘܦܐܪܕ ܠܐ ܚܕܐ ܐܡܝܢܐ (٦ - ٢٣) ܐ. ܒ ܚܙܝ:

1 . ܚܘܫܒܬܐ ܕܟܠ ܡܫܘܫܐ ܘܩܘܕܪܐ ܕܟܘܪܝܐ ܒܬܪ ܐܣܪܬܐ.

٢ . ܐ، ܦܬܠܗ ܡܘܡܚܐ ܒܛܘܦܐ ܡܫܝܬܐ ܕܟܠܡܫܘ ، ٢ ، ܒܝܢ ܕܪܘܝܗ ܠܘܚܐ ܕܐܪܢܝܐ ܡܢ ܓ̰ܒܐ ܦܘܫܐ ܒܡܐ ܒܩܝܒ ܦܘܕܪܐ ܕܟܘܪܝܐ ܕܒܘܟܬܐ ؛

٣ . ܒܘܢܐ ܕܛܘܩܦܐ ܙܡܝܢܐ ܒܟܠ ܡܫܘܫܐ ܒܬܪ ܡܬܒܬܐ ܕܛܘܦܐ.

٤ . ܛܘܩܦܐ ܟܠܢܝܐ ܙܡܝܢܐ ܡܢܘ ܡܬܒܬܐ ܕܛܘܦܐ ܘܒܬ ܐ ܕܐܗܐ.

ܐܣܟܡܐ (٦ — ٢٣ ܐ)

ܫܪܝܐ :

ܫ١ = ܦ١ ܡܣ١

= ٦٠ × ١٢ ܡܡܦ

= ٧٢٠ ܡܝܩܪܘܟܘܠܘܡ ܫܘܒܬܐ
ܕܡܫܦܡܐ ܩܕܡܝܐ ܘܓܦܫܝܐ ܫܘܒܬܐ
ܟܠܢܝܬܐ ܥܠ ܗܕܘܟ ܡܫܦܡܐ

ܡܣ = ܡܣ١ + ܡܣ٢

= ١٢ ܡܡܦ + ٨ ܡܡܦ

= ٢٠ ܡܡܦ ܡܫܦܡܐ ܟܠܢܝܐ

ܦ = ܫ / ܡܣ = ٧٢٠ ܡܟܠ / ٢٠ ܡܡܦ = ٣٦ ܒܠ ܦܘܠܛܐ ܕܡܘܥܢܐ ܟܠܢܝܐ ܠܥܘܒܕܐ ܕܦܨܘܪܐ

ܫ١ = ٣٦ × ١٢ = ٤٣٢ ܡܟܠ ܫܘܒܬܐ ܕܡܫܦܡܐ ܩܕܡܝܐ ܒܬܪ ܐܫܬܐ
ܘܩܕܡ ܡܚܒܪܬܐ ܕܒܬܘܪܐ.

ܫ٢ = ٣٦ ܒܠ × ٨ ܡܡܦ = ٢٨٨ ܡܟܠ ܫܘܒܬܐ ܕܡܫܦܡܐ ܬܪܝܢܐ ܒܬܪ
ܐܫܬܐ ܘܩܕܡ ܡܚܒܪܬܐ ܕܒܬܘܪܐ

٢) ܒܬܪ ܡܚܒܪܬܐ ܕܒܬܘܪܐ ܐܝܟ ܐܣܟܡܐ (٦ ـ ٢٣ ܒ) ܠܐ ܫܚܠܦܐ ܫܘܒܬܐ
ܟܠܢܝܬܐ ܐܠܐ ܦܫܐ ܡܚܕܬܐ

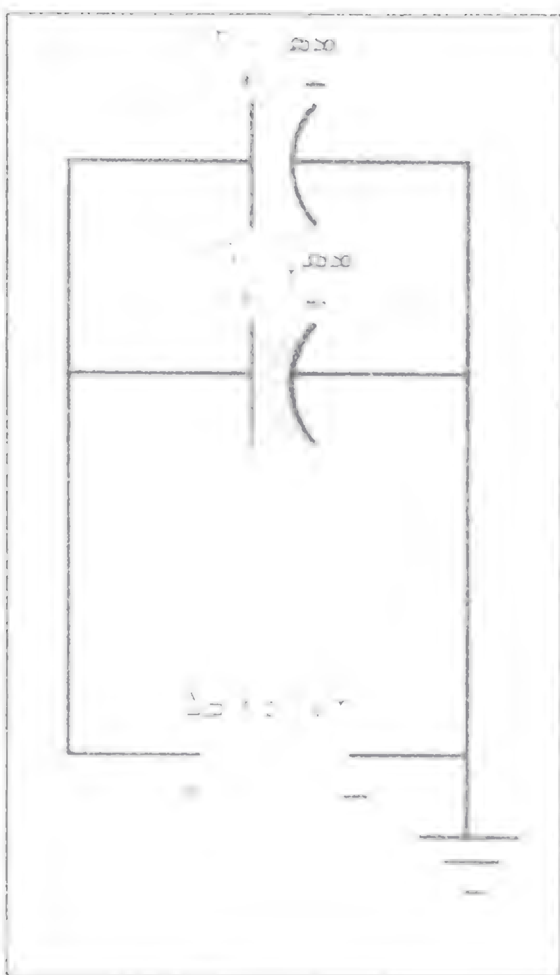
= ٧٢٠ ܡܟܠ ܒܝܠܬܐ ܕܠܬܘܬܐ ܕܡܫܘܚܐ ܡܫܝܢܐ

ܡܣ٢ ܓ = ܡܣ٢ ܡܣ٢ ܦ

= ٢ × ٨ = ١٦ ܡܡܦ ܡܫܦܡܘܬܐ ܕܡܫܦܡܐ ܬܪܝܢܐ ܒܬܪ ܡܚܒܪܬܐ ܕܒܬܘܪܐ.

ܡܣ = ܡܣ١ + ܡܣ٢ = ١٢ ١٦ = ٢٨ ܡܡܦ

ܦ = ٧٢٠ / ٢٨ = ٢٥.٧٢ ܒܘܠܛ ܦܘܠܛܐ ܕܡܘܥܢܐ ܕܥܘܒܕܐ



ܐܫܚܢܐ (٦ – ٢٣ ܒ)

٣، ܟ١ = ܓ١ × ܡܣ١

ܟ١ = ٢٥٫٧٢ × ١٢ = ٣٠٨٫٦٤ ܡܚܠ ܥܣܘܕܐ ܢܠ ܡܚܦܡܐ ܡܒܡܢܐ ܦܚܕ ܡܚܒܚܐ ܒܚܕܘܡܐ

ܕܘܡܦܐ ܝܡܒܕܐ ܠܘܣ = $\frac{١}{٢}$ ܓ ܟ١

= $\frac{١}{٢}$ × ٢٥٫٧٢ × ٣٠٨٫٦٤ × ١٠$^{-٦}$

= ٣٩٦٩ × ١٠$^{-٧}$ ܠܘܠ

ܟ٢ = ܓ٢ × ܡܣ٢

= ٢٥٫٧٢ × ١٦ = ٤١١٫٥٢ ܡܚܠ

ܕܘܡܦܐ ܝܡܒܕܐ ܠܘܣ = $\frac{١}{٢}$ × ٢٥٫٧٢ × ٤١١٫٥٢ × ١٠$^{-٦}$

$= ٥٢٩٢ \times ١٠^{-٧}$ ܓܘܠ

ܐܘܢܩܐ ܚܠܝܢܐ ܝܘܒܢܐ ܩܕܡ ܡܬܒܥܐ ܕܥܬܐܘܪܐ $= \frac{١}{٢}$ ܦ^{٢} ܡܚ

$= \frac{١}{٢} \times (٣٦)^{٢} \times ٢٠ \times ١٠^{-٦}$

$= ٠.٠١٢٩٦$ ܓܘܠ

ܐܘܢܩܐ ܚܠܝܢܐ ܝܘܒܢܐ ܬܪܝܢ ܡܬܒܥܐ ܕܥܬܐܘܪܐ $= \frac{١}{٢}$ ܦ^{٢} ܡܚ

$= \frac{١}{٢} \times (٢٥.٧٢)^{٢} \times ٢٨ \times ١٠^{-٦} = ٠.٠٠٠٩٢٦١$ ܓܘܠ

ܡܘܬܠܐ (١٥)

ܦܪ̈ܠܘ ܐܝܟܢܐ ܬܪܝܢ ܡܚܩܢܐ ܡܩܢܘܬܗ (٣ ܡܚܦ ، ٦ ܡܚܦ) ܒܢܩܘܦܐ ܥܡ ܦܪ̈ܠܘ ܐܝܟܢܐ ܬܠܬ ܒܘܢܝܗ ܒܢܩܘܦܘܬܐ ܡܩܢܘܬܐ (٩ ܡܚܦ) ܘܠܗ ܦܪ̈ܠܘ ܐܝܟܢܐ ܠܦܘܪܢܐ ܕܚܘܫܢܐ (١٠٠ ܒܘܠܛ) ܐܝܟܢܐ (٦ - ٢٤) ܚܫܒ:

١. ܚܘܝܬܐ ܚܠܝܢܬܐ ܘܚܘܝܬܐ ܕܟܠ ܡܩܢܐ ܘܦܘܪ̈ܢܐ ܕܟܘܫܝܗ.

٢. ܐܢ ܦܪ̈ܠܘ ܦܪܝܫܐ ܒܢܘܫܬܐ ܡܢ ܡܚܘܒܐ ܘܢܬܠܩܚܐ ܕܦܘܫܐ ܒܝܢ ܠܘܬ ܕܡܩܢܐ ܚܠܝܢܐ ܒܢܘܠܐ ܚܬܘܡܐ ܦܪ ܦܘܪ̈ܢܐ ܕܚܘܫܢܐ ܕܚܘܫܢܐ (٥٥ ܒܘܠܛ) ܐܝܟ ܡܫܚܬܐ ܕܥܬܐܘܪܐ؟

ܫܪܝܐ

$١ .\ \frac{١}{ܡܚ} = \frac{١}{ܡܚ_{١}} + \frac{١}{ܡܚ_{٢}}$

$\frac{١}{ܡܚ} = \frac{١}{٦} + \frac{١}{٣}$

ܡܡ = ٢ ܡܟܦ ܡܫܘܚܬܐ ܠܘܡܓ̈ܠܐ ܠܗܕܘܝܐ ܡܫܘܚܬܐ ܢܘܟܐ

ܡܡ ܟܠܢ̈ܝܐ = ٩ + ٢ = ١١ ܡܟܦ ܡܫܘܚܬܐ ܠܘܡܓ̈ܠܐ ܕܒܢ̈ܕܐ

ܛܟ = ١٠٠ ܦܠ × ١١ ܡܟܦ = ١١٠٠ ܡܟܠ ܛܥܘܢܬܐ ܟܠܢܝܬܐ

ܛ٣ = ١٠٠ ܦܠ × ٩ ܡܟܦ = ٩٠٠ ܡܟܠ ܛܥܘܢܬܐ ܕܬܠܝܬܝܐ

ܛ١ = ܛ٢ = ١٠٠ ܦܠ × ٢ ܡܟܦ = ٢٠٠ ܡܟܠ ܘܗܝ ܛܥܘܢܬܐ ܕܢܩܦܘܬܐ

ܦ١ = ٢٠٠ / ٦ = ١٠٠ / ٣ ܦܠ

ܦ٢ = ٢٠٠ / ٣ ܦܠ

٢ . ܟܬܘܒ ܡܫܘܚܬܐ ܕܟܬܘܡܐ

ܡܡ ܟ = ܛ ܟ / ܦ ܟ

ܡܡ ܟ = ١١٠٠ ܡܟܠ / ٥٥ ܦܠ = ٢٠ ܡܟܦ

ܨܘܪܬܐ ٦ — ٢٤ : ܐ ، ܒ

ܡܡ ܟ = ܡܡ٣ ܟ + ܡܡ

٢٠ = ܡܡ٣ ܟ + ٢

ܡܡ٣ ܟ = ١٨ ܡܟܦ

ܡܫ ܟ = ܡܡ ܟ / ܡܡ ܦ = ١٨ / ٩ = ٢ ܡܫܘܚܬܐ ܕܟܬܘܡܐ

ܒܘܚܪ̈ܢܐ

ܒ̇[1] : ܥܢܝ ܠܦܘ̈ܢܝܐ ܗܳܠܶܝܢ ܒܟܠ ܡܶܢ ܡܳܐ ܕܐܳܬܐ :

١ : ܓܒܝ ܡܢܘ ܒܗܠܝܢ ܟܠ ܗܕܐ ܒܣܘܢܬܐ :

ܐ - ܒܡܕ̈ܝܢܬܐ ܦܢܝ̈ܩܝܬܐ ܒܒܘܢ̈ܝܐ ܕܡܛܪ̈ܬܐ ܕܝܘܢܐ.

ܒ - ܒܡܕ̈ܝܢܬܐ ܦܢܝ̈ܩܝܬܐ ܐܝܟ ܒܡܕ̈ܝܢܬܐ ܒܝܬ ܢܗܪ̈ܝܢ ܘܡܨܪܝܢ.

ܓ - ܒܡܕ̈ܝܢܬܐ ܦܢܝ̈ܩܝܬܐ ܣܕܝܡܐ ܗܢܕܝܩܝܬܐ.

ܕ - ܦܘܢܝ̈ܩܝܐ.

٢ ܫܘܪܝܐ ܕܟܬܝܒܬܐ ܕܐܒܓܕܝܬܐ ܠܡܫܝ̈ܚܝܐ ܒܐܝܕܐ ܫܢܬܐ ܗܘܬ

ܐ - ܩܕ ܐܬ̈ܐ ܕܡܬܝܢܬܐ ܠܗ ܕܗܘܐ ܠܗ ܐܬ̈ܐ ܝܬܝܪ̈ܐ.

ܒ - ܩܕ ܩܘܕܐ ܕܡܬܝܢܬܐ ܠܗ ܕܗܘܐ ܠܗ ܐܬ̈ܐ ܝܬܝܪ̈ܐ.

ܓ - ܒܡܐ ܒܟܠܝܗ ܢܘܦܘܗ.

ܕ - ܟܠܝܗ ܚܬܝܬܐ ܝܚܝܕܐ.

٣ : ܐܝܟ ܐܝܠܝܢ ܕܐܬ̈ܘܢ ܡܠܟ̈ܐ ܠܗܘܢ ܗܘܐ :

ܐ - ܒܗܢܐ ܒܟܠܗ ܢܘܦܘܐ.

ܒ - ܐܠܗܘܬܐ ܐܢܫܝܬܐ.

ܓ - ܫܘܡܗܐ ܘܐܠܗܘܬܐ ܒܠܚܘܕ.

ܕ - ܬܪ̈ܝܢ ܫܘܡ̈ܗܐ ܐܘ ܐܠܗܘܬܐ ܐܘ ܟܬܒܐ.

٤ - ܠܡܢܐ ܕܐܬ̈ܘܬܐ ܒܝܢ ܗܕܐ ܠܗܝܢ ܡܥܒܪ̈ܢܐ ܒܣܝܢܐ ܒܗܕܐ ܒܣܘܢܬܐ
ܦܪܝܫܐ

ܐ - ܫܘܡܗܐ ܐܢܫܝܬܐ

ܒ - ܐܠܗܘܬܐ ܐܢܫܝܬܐ

ܓ - ܫܘܡܗܐ ܘܐܠܗܘܬܐ ܒܠܚܘܕ

ܕ - ܟܠܗܐ ܫܘܡܗܐ ܐܘ ܐܠܗܘܬܐ ܐܘ ܟܬܒܐ

٥ ܠܡ ܡܕܢܚܝܬܐ ܕܠܗܝܢ ܕܡܫܟܚܐ ܐܢܫܐ ܠܡܩܪܝܢܐ ܚܕ ܡܢ ܦܘܠܓܐ
ܕܐܬܝ ܠܗ ܚܝܠ :

ܐ - ܡܫܡܘܥܘ ܦܝܪܐ

ܒ - ܦܘܪܫܢܐ ܕܠܡܒܝܘ ܡܡܠܠܐ

ܓ - ܒܣܘܢܬܐ ܦܝܪܐ

ܕ - ܙܠܝܬܐ ܕܠܡܒܝܢܐ ܒܝܢ ܠܗܝܘ ܦܝܪܐ.

٦ ܡܫܟܚܐ ܒܣܝܢܐ ܠܐ ܐܢܫܐ ܠܡܩܪܝܢܐ ܦܬܓܡܐ ܡܢ ܡܠܦ̈ܢܐ ܟܠܗܘܢ ܒܝܢ
ܠܗܝܘ :

ܐ - ܡܫܡܘܥܘ ܦܝܪܐ

ܒ - ܦܘܪܫܢܐ ܕܠܡܒܝܘ ܘܝܬ

ܓ. ܚܘܫܒܢܗ ܡܫܘܚܬܐ   ܕ. ܟܘܪܐ ܕܠܒܝܫܬܐ ܡܢ ܠܘܬܗ ܘܝܕ

٧ : ܡܢ ܬܝܬܝܐ ܕܠܘܒܕܐ ܠܐ ܚܫܝܒܬܐ ܐܚܕܬܗ ܡܘܬܪܐ ١٠ ^٣ ܐܠܩܛܪܘܢ،
ܘܚܘܫܒܢܗ ܟܡܝܬܐ :

ܐ) (+ ١.٦ × ١٠ ^{-١٦}) ܟܠ   ܒ) (+ ١.٦ × ١٠ ^{-٢٣}) ܟܠ

ܓ) (− ١.٦ × ١٠ ^{-١٦}) ܟܠ   ܕ) (− ١.٦ × ١٠ ^{-٢٣}) ܟܠ

٨ : ܠܘܒܕܐ ܡܫܬܠܡܢܬܐ ܚܫܝܒܬܐ ܘܡܫܘܚܬܐ ܠܘܒ̈ܕܐ ܕܚܕ ܡܢ ܬܘܟܣܐ
ܕܬܠܬܗ ١ ܟܘܠܘܡ ܠܘܒ̈ܕܐ ܕܡܫܬܠܡܢܘܬܗ ܗܘܐ :

ܐ. (١) ܟܘܠܘܡ   ܒ. ܨܦܝܪܐ

ܓ. ܙܥܘܪܐ ܡܢ ١ ܟܘܠܘܡ ܘܪܒ ܡܢ ܨܦܝܪܐ   ܕ. ܪܒ ܡܢ ١ ܟܘܠܘܡ

٩ : ܚܕܐ ܡܢ ܡܫܘܚܬܐ ܕܠܐ ܫܘܚܠܦܬܐ ܗ̄ܝ :

ܐ. ܨܦܝܘܬܐ   ܒ. ܚܫܝܒܬܐ

ܓ. ܦܪ̈ܫܐ ܕܠܘܒ̈ܕܐ   ܕ. ܟܘܪܐ ܕܠܒܝܫܬܐ ܕܗܪ̈ܟܐ

١٠ : ܡܫܘܚܬܐ ܕܡܫܘܚܬܐ ܕܗܪ̈ܟܬܐ ܕܗܘܠܐ ܐܝܬ ܠܗ :

ܐ. ܬܝܬܝܘܬܐ ܕܠܘܬ ܕܡܫܟܢܐ   ܒ. ܠܒܝܫܬܐ ܕܗܘܠܐ ܟܠܗܘܢ

ܓ. ܐܪ̈ܒܐ ܕܗܘܠܐ ܟܠܗܘܢ   ܕ. ܚܘܫܒܢܐ ܕܡܫܟܢܐ

ܒ٢ : ܕܐܝܢ ܦܫܛ ܘܢܗܪܐ ܕܨܦܝܘܬܐ ܕܡܫܟܢܐ :

ܐ. ܟܡܝܬܐ ܕܬܝܬܝܘܬܐ ܕܠܘܬܗ ܒܬܘܟܠܢܐ   ܒ. ܟܡܫܬܢܬܐ ܕܠܘܬܗ

ܓ. ܟܡܫܟܢܬܐ ܕܗܘܠܐ ܟܠܗܘܢ ܒܝܢ ܠܘܬܐ ܡܢ ܠܒܝܒ ܦܘܫܐ.

ܒ٣ : ܐܝܟܠܘܢ ܠܘܒܕܐ ܚܫܝܒܬܐ ܒܚܘܫܒܬܐ ܐܠܘܗܬܐ ܕܐܝܢ ܡܢܝܢ ܚܫܝܒܬܐ
ܕܡܢ ܠܘܒ̈ܕܐ ܡܘܡܬܠܐ ܒܡܢ ܚܘܫܒܬܐ ܦܪܝܫܐ ܕܠܐ ܫܠܝܛܐ ܚܘܫܒܬܐ
ܕܠܘܒܕܐ ܝܬܝܪܬܐ ؟

ܒ٤ : ܐܝܟ ܡܚܘܝܐ ܢܛܦܬܐ ܐܘ ܢܦܩܬܐ ܒܝܢ ܬܪܝܢ ܠܘܒܫܐ ܡܚܘܝܬܐ
ܡܬܝܠܬܐ ܕܬܪܘܝ ܠܘܒܫܐ ܚܫܝܒܐ ܠܗܝ ܦܫܛ ܐܝܟ.

ܒ٥ : ܦܫܛ ܒܝܢ ܡܫܘܚܬܐ ܕܦܫܛܘܬܐ ܠܗ ܗܢܘ. ܟܘܠܘܡ ܘܡܫܘܚܬܐ ܕܢܦܩܬܐ
ܠܘܒ̈ܕܐ

ܫ٦ : ܡܵܢ ܐܝܼܠܵܐ ܠܦܘܼܬ ܕܝܼܗ ܗܘܼܝܵܐ ܕܦܘܼܪܫܵܢܵܐ ܕܟܘܼܫܵܝܵܐ ܒܹܝܢ ܟܪܵܝ ܢܘܼܫܵܐ.

ܫ٧ : ܟܬܘܿܒ ܫܡܵܗ̈ܐ ܕܐܲܪܒܥܵܐ ܫܲܢ̈ܝܵܬܵܐ ܘܟܠܚܕܵܐ ܩܢܘܼ ܒܹܝܢ ܗܵܘܦܵܐ ܟܝܢ̈ܐ ܘܦܓܪ̈ܐ ܡܢ ܓܘ :

ܐ . ܫܢܝܼܬܵܐ ܕܟܣܘܼܝܵܐ   ܒ . ܟܘܼܪܵܐ ܕܓܒܝܼܠܵܐ ܒܗܘܪ̈ܐ.

ܓ . ܟܘܼܫܵܝܵܐ ܕܢܘܼܫܵܐ ܥܠ ܟܠ ܗܘܦܵܐ   ܕ . ܟܣܘܼܝܵܐ ܕܗܘܦܘܗ

ܫ٨ : ܟܠ ܢܘܼܫܵܐ ܐܘ ܟܘܼܫܵܝܵܐ ܡܘܼܫܚܬܵܐ ܒܪܵܒܵܐ ܟܘܼܫܵܝܘܼ = ܩܘܼܦܵܐ ܕܐܝܼܢ ܥܠܠܐ ܐܝܼܬ ؟

ܫ٩ : ܗܲܒ ܦܘܼܩܕܵܢܵܐ ܠܟܠ ܡܢ ܗܵܠܝܢ ܘܥܠܠܬܵܐ ܠܐܝܼܬ ܒܟܘܼܫܵܝܵܐ :

ܐ . ܟܘܼܫܵܝܵܐ ܗܘܦܵܐ ܕܟܣܘܼܝܵܐ ܡܢ ܟܘܼܫܵܝܵܐ ܗܘܦܵܐ.

ܒ . ܟܘܼܫܵܝܵܐ ܓܠܘܼܪܵܐ ܕܟܣܘܼܝܵܐ ܡܢ ܟܘܼܫܵܝܵܐ ܓܠܘܼܪܵܐ.

ܓ . ܟܘܼܫܵܝܵܐ ܟܣܘܼܝܗ ܗܘܦܵܐ ܘܟܘܼܫܵܝܘܼ = ܩܘܼܦܵܐ

ܕ . ܟܘܼܫܵܝܵܐ ܓܠܘܼܪܵܐ ܕܟܣܘܼܝܵܐ ܘܟܘܼܫܵܝܘܼ = ܩܘܼܦܵܐ

ܫ١٠ : ܗܲܕܸܡ ܠܡܵܢ ܗܵܠܝܢ ܒܫܘܼܠܵܡܵܐ ܐܚܪ̈ܢܐ :

ܐ . ܒܝܼܠܝܼܕ   ܒ . ܦܪܵܕ   ܓ . ܓܘܼܠ

ܫ١١ : ܐܵܢܵܐ ܕܟܘܼܪܵܐ ܕܓܒܝܼܠܵܐ ܒܗܘܪ̈ܐ = ܓܠܝܵܐ ܕܟܘܼܫܵܝܵܐ. ܡܵܢ ܥܠܵܗ ܒܥܕܵܢܵܐ ܕܟܡܵܝܬܵܐ ܕܗܵܘܐ ܐܚܝܼܢܬܵܐ ؟

ܫ١٢ : ܕܐܝܼܢ ܦܠܚܵܐ ܡܚܠܦܢܘܼܬܵܐ ܕܒܟܡܵܐ ܟܠ ܢܦܝܼܩܬܵܐ ܕܒܢܝܵܐ ܡܢ ܡܟܬܒܢܘܼܬܵܐ ܕܒܟܡܵܐ ؟

ܫ١٣ : ܐܵܢܵܐ ܗܲܕܸܡ ܕܗܘܝܼ ܟܠܗܘܿ ܢܗܘܼܦ ܠܗ ܒܗܘܪ̈ܐ ܥܠܝܬܵܐ ܡܢܟܝܢ̈ܐ ܒܐܢܐ ܕܓܒܝܼܠܵܐ ؟ ܘܠܡܵܢ ؟

ܫ١٤ : ܐܵܢܵܐ ܡܫܝܼܢܵܐ ܠܗܘ ܕܡܫܚܠܦ ܗܵܕܵܐ ܫܢܝܼܬܵܐ ܡܢ ܫܢܝܼܬܵܐ ܕܫܠܝܼܐ ܒܗܘܪ̈ܐ ؟ ܘܠܡܵܢ ؟

ܒ ١٥ : ܐܪܐ ܡܚܝܒܬܐ ܝܠܗ ܕܡܬܠܒܫ ܗܕܝ ܫܠܝܚܐ ܡܢ ܫܠܝܚܐ ܕܒܥܘܗܝ
ܠܘܒܢܐ؟ ܘܠܡܐ؟

ܒ ١٦ : ܐܪܐ ܡܚܝܒܬܐ ܝܠܗ ܫܚܝܢܐ ܕܠܘܒܢܐ ܡܟܘܚܐ ܠܗܕܝ ܫܚܘܢܘܬܐ
ܕܗܘܪܬܐ ܦܪܝܫܐ؟

ܒ ١٧ : ܡܦܩܢܐ ܫܚܝܢܐ ܘܠܐ ܡܘܡܚܝܢܐ ܠܡܟܘܢܐ ܦܬܠܗ ܫܘܚܠܦܐ ܦܘܫܐ
ܒܝܢ ܠܘܚܗ ܠܟܠܗܘܢܐ ܐܚܪܢܐ ܡܢ ܝܠܗ ܡܟܟܪܝܘܬܐ ܕܐܗܐ ܠܟܠ ܡܢ :

ܐ. ܠܘܒܢܐ ܕܟܝܒܠܐ ܒܝܢ ܠܘܚܗ ܒ. ܫܚܘܢܘܬܗ
ܓ. ܦܘܪܫܢܐ ܕܠܘܒܢܐ ܒܝܢ ܠܘܚܗ ܕ. ܡܦܩܢܘܬܗ

ܒ ١٨ : ܓܘܒܢܐ ܫܦܪܐ ܠܡܚܐ ܘܫܚܝܢܐ ܕܐܝܟ ܡܫܘܚ ܗܘܟܪܢܝܬ ܕܟܠܗ
ܢܘܩܙܐ ܕܐܗܐ ܡܡܚܝܢܐ ܫܒܝܪ ܠܘܒܢܐ ܝܠܗ؟

ܒ ١٩ : ܗܕܝ ܫܚܘܢܘܬܐ ܢܘܩܙܢܝܐ ܬܘܢ ܠܟܘܝܠܐ ܘܦܪܝܫܐ ܠܢܘܒܢܐ ܠܡܐ ܝܠܗ
ܟܘܝܠܐ ܕܫܘܒܠܐ ܐܢܫܢܐ ܠܬܢܝܬܐ ܕܫܚܘܢܘܬܐ ܕܗܘܪܬܐ ܥܠ ܚܘܪܒܢܐ ܕܟܡܘܟܐ
ܡܦܠܓܢܐ ܕܠܘܟܕܐ ܒܝܢ ܗܪܘܗܝ ܫܚܘܢܘܬܐ؟ ܦܝܫ ܠܐܗܐ؟

ܒ ٢٠ : ܡܢ ܝܠܗ ܟܝܠܬܐ ܕܗܘܪܟܘܬܐ ܕܐܐܪ ܓܫܘܐ؟

ܒ ٢١ : ܠܡܐ ܗܘܝ ܪܟܡܐ ܟܕ ܬܪܬܝܢ ܬܪܬ ܡܬܟܪܐ؟

ܒ ٢٢ : ܗܕܝ ܫܚܘܢܘܬܐ ܢܘܩܙܢܝܐ (٠٫٦) ܡܝܟܪܘܟܘܠܘܡ. (٠٫٢)
ܡܝܟܪܘܟܘܠܘܡ ܠܘܟܕܐ ܬܢܝܬܗ ٣٠ ܣܢܬܝܡܝܬܪܐ ܫܟܝܚ ܚܝܠܐ ܕܗܘܪܟܐ
ܡܬܚܠܦܢܐ ܬܢܝܬܗ؟ ܦ : ٠٫٠١٢ ܢܝ

ܒ ٢٣ : ܐ. ܦܘܪܫܢܐ ܕܠܘܒܢܐ ܒܝܢ ܗܕܝ ܢܘܩܙܬܐ ܐ . ܒ = ٦٠ ܒܘܠܛ ܟܡܐ
ܝܠܗ ܟܘܝܠܐ ܕܫܘܒܠܐ ܐܢܫܢܐ ܠܬܢܝܬܐ ܕܐܠܩܛܪܘܢ ܡܢ ܐ ܠ ܒ ܘܟܡܐ ܝܠܗ ܟܘܝܠܐ
ܕܫܘܒܠܐ ܐܢܫܢܐ ܠܬܢܝܬܐ ܕܦܪܘܛܘܢ ܡܢ ܐ ܠ ܒ؟
ܦ : - ٩٫٦ × ١٠$^{-١٨}$ ܓܘܠ ، ٩٫٦ × ١٠$^{-١٨}$ ܓܘܠ

ܫ٢٤ : ܟܡܐ ܗ̄ܘ ܚܝܠܐ ܕܚܘܪܐ ܕܓܠܝܓܠܐ ܡܘܪ̈ܟܐ ܡܢ ܗܕܐ ܠܘܚܐ
ܡܟܘܢܐ ܚܕܝܐ ܠܦܘܪ̈ܫܐ ܕܟܘܟ̈ܒܐ ٦ ܒܦܘܠܛ ، ܐ. ܒܡܟܝܪܐ ܟܢܫܬܐ ܗܘܐ ٢
ܡܠܝܢܬܐ ؟ ܦ : ٣×١٠^{٣} ܟܠ\ܡ

ܫ٢٥ : ܗܕܐ ܠܘܚܐ ܡܟܘܢܐ ܦܘܪ̈ܫܐ ܕܟܘܟ̈ܒܐ ܟܢܫܬܐ (٦) ܒܦܘܠܛ
ܘܬܠܬܐ ܕܟܘܟ̈ܒܐ ܟܢܫܬܐ ٣٠٠ ܒܦܘܠܛ ܡܠܝܢܬܐ . ܚܫܘܒ :
١ . ܒܡܟܝܪܐ ܡܢ ܗܕܐ ܠܘܚܐ.
٢ . ܚܝܠܐ ܕܡܘܪ̈ܟܐ ܡܟܝܪ̈ܐ ܕܐܠܩܛܪܘܢ ܡܢ ܗܕܐ ܠܘܚܐ.
ܦ : ٢ ܗܡ ، $٤٫٨ \times ١٠^{-١٧}$ ܢܛ

ܫ٢٦ : ܗܕܐ ܟܣܘܝܬܐ ܢܘܩܙܬܐ (٦ ܡܟܠ) . (-٣ ܡܟܠ) ܒܡܟܝܪܐ ܟܢܫܬܐ
٦٠ ܗܡ ܐܟܚܫ :
١ . ܠܘܟܪܐ ܕܢܘܩܙܬܐ ܢܦܠܐ ܒܝܬ ܡܨܥܬܐ ܕܒܡܟܝܪܐ ܡܢ ܗܕܐ ܟܣܘܝܬܐ .
٢ . ܟܘܠܐ ܐܝܬܝܐ ܠܬܢܝܬܐ ܕܟܣܘܝܬܐ ܒܗܠܝܢ ٣ ܡܟܠ ، ܡܢ ܟܝܠܐ ܕܐܪܟܐ
ܠܗ̇ ܐܝܟ ܢܘܩܙܬܐ ؟
٣ . ܚܘܪܐ ܕܓܠܝܓܠܐ ܡܘܪ̈ܟܐ ܒܐܪܐ ܢܘܩܙܬܐ.
ܦ : ٩×١٠^{٤} ܒܦܘܠܛ ، ٢٧×١٠^{-٣} ܓܘܠ ، $٩٫٦ \times ١٠^{-١٨}$ ܢܘܛܢ\ܟܠ

ܫ٢٧ : ܦܬܝܠܐ ܐܚܕܐ ܡܩܦܐ (٦٠ ܡܝܩܪܘܦܪܕ) (٣٠ ܡܝܩܪܘܦܪܕ
ܒܢܩܦܬܐ ܘܟܠܗ ܐܚܕܐ ܠܡܟܘܬܐ ܕܒܦܘܠܛܐ ܐܡܝܢܐ ܒܦܘܠܛܝܘܬܗ (١٠٠)
ܒܦܘܠܛ ܚܫܘܒ (١) ܦܘܪ̈ܫܐ ܕܟܘܟ̈ܒܐ ܕܟܠ ܡܩܦܐ (٢) ܟܣܘܝܬܐ ܕܟܠ ܡܩܦܐ.

$$\text{ܦ} \quad \frac{١٠٠}{٣} \text{ ܟܠ} \qquad \frac{٢٠٠}{٣} \text{ ܟܠ} \qquad ٢٠٠٠ \text{ ܡܟܠ}$$

ܫ٢٨ : ܦܬܝܠܐ ܐܚܕܐ ܡܩܦܐ (١٢ ܡܝܩܪܘܦܪܕ) ٢٨ ܡܝܩܪܘܦܪܕ
ܒܢܩܦܬܐ ܘܟܠܗ ܐܚܕܐ ܠܒܦܘܠܛܝܘܬܐ ܐܡܝܢܬܐ (٣٠) ܒܦܘܠܛ . ܚܫܘܒ
١ . ܟܣܘܝܬܐ ܕܟܠ ܡܩܦܐ ܘܟܣܘܝܬܐ ܟܠܢܝܬܐ.

٢ ـ ܐ. ܦܬܠܗ ܡܬܘܝܠܦܐ ܦܘܫܐ ܒܝܡ ܕܪܘܝܗ ܠܘܝܐ ܕܡܥܡܨܐ ܡܕܡܢܐ ܒܪܘܡܐ ܒܦܬܐ ܥܣܘܢܬܐ ܕܒܢܘܥܬܐ (٣٠٠٠) ܡܚܠ ܝܬܝܡ ܡܪܝܬܐ ܕܒܪܡܪܐ؟

ܦ : ١ ـ ٣٦٠ ܡܚܠ . ٨٤٠ ܡܚܠ . ١٢٠٠ ܡܚܠ

ܒ٢٩ : ܪܕܝ ܡܥܡܨܐ (٢) ܡܫܪܘܦܪܕ. (٤) ܡܫܪܘ ܦܪܕ ܐܝܪܐ ܒܥܒܘܪܬܐ ܒܡ ܦܬܠܗ ܐܝܪܐ ܡܥܡܨܐ (٣) ܡܫܪܘܦܪܕ ܒܢܫܘܩܬܐ ܠܡܝܗ ܘܒܢܘܥܬܐ ܦܬܠܗ ܥܣܝܬܐ ܡܢ ܡܒܘܟܐ ܐܡܢܐ ܠܒܕܠܘ ܥܣܘܢܬܐ ܕܒܢܘܥܬܐ ܕܠܢܬܐ (٣٠٠) ܡܚܠ ܝܬܝܡ.

١ ـ ܦܘܪܢܐ ܕܟܘܥܢܐ ܕܡܒܘܟܐ ܥܝܢܐ . ٢ ـ ܥܣܘܢܬܐ ܕܟܠ ܡܥܡܨܐ ٣ ـ ܦܘܪܢܐ ܕܟܘܥܢܐ ܕܟܠ ܡܥܡܨܐ.

ܦ : ١٥٠ ܓܠ ، ١٠٠ ܡܚܠ ، ٢٠٠ ܡܚܠ ، ٣٠٠ ܡܚܠ ، ١٠٠ ܓܠ ، ٥٠ ܓܠ ܠܕܪܘܝܗ ܡܥܡܨܐ ٤ ، ٣

ܒ٣٠ : ܦܬܠܗ ܐܝܪܐ ܕܪܘܝܗ ܡܥܡܨܐ (٢) ܡܫܪܘܦܪܕ. (٨) ܡܫܪܘܦܪܕ ܒܥܒܘܪܬܐ ܘܒܢܘܥܬܐ ܦܬܠܗ ܥܣܝܬܐ ܒܥܣܘܢܬܐ ܒܡܠܬܗ (١٠٠٠) ܡܫܪܘܒܘܠܬܗ.

١ ـ ܟܡܐ ܝܠܗ ܥܣܘܢܬܐ ܕܟܠ ܡܥܡܨܐ ܘܦܘܪܢܐ ܕܟܘܥܢܗ.

٢ ـ ܐ. ܦܬܠܗ ܒܘܝܠܦܐ ܦܘܫܐ ܒܡ ܪܕܝܗ ܠܘܝܐ ܕܡܥܡܨܐ ܡܕܡܢܐ ܒܘܠܐ ܡܪܝܬܐ ܕܒܪܡܪܗ = ٦ ܟܡܐ ܒܦܬܐ ܥܣܘܢܬܐ ܕܟܠ ܡܥܡܨܐ ܘܦܘܪܢܐ ܕܟܘܥܢܗ

ܦ : ١٠٠ ܓܠ . ٨٠٠ ܡܚܠ ، ٢٠٠ ܡܚܠ ، ٥٠ ܓܠ ، ٤٠٠ ܡܚܠ ، ٦٠٠ ܡܚܠ

ܒ٣١ : ܪܠܬܐ ܡܥܡܨܐ ܡܫܘܚܝܗ (٥) ܡܫܪܘܦܪܕ. (٧) ܡܫܪܘܦܪܕ. (٦) ܡܫܪܘܦܪܕ ܦܬܠܗ ܐܝܪܐ ܡܕܡܢܐ ܘܪܕܢܐ ܒܥܒܘܪܬܐ ܘܦܬܠܗ ܐܝܪܐ ܪܠܬܐ ܠܡܝܗ ܒܢܫܘܩܬܐ ܘܒܢܘܥܬܐ ܦܬܠܗ ܡܘܡܨܝܬܐ ܒܝܕ ܡܘܨܒܐ ܕܡܒܘܟܐ ܐܡܢܐ ܦܘܪܢܐ ܕܟܘܥܢܗ (٦٠) ܒܘܠܝܕ ܟܡܐ ܝܠܗ ܥܣܘܢܬܐ ܕܟܠ ܡܥܡܨܐ ܘܦܘܪܢܐ ܕܟܘܥܢܗ؛ ܘܟܡܐ ܝܠܗ ܪܘܡܐ ܙܥܘܪܐ ܒܟܠ ܡܥܡܨܐ ܘܟܠܗ ܒܢܘܥܬܐ ܕܡܥܡܨܐ؟

ܦ : ٢٤٠ ܡܚܠ . ١٠٠ ܡܚܠ . ١٤٠ ܡܚܠ . ٤٠ ܓܠ . ٢٠ ܓܠ

[٤٨٠٠ ܓܘܠ . ١٤٠٠ ܓܘܠ . ١٠٠٠ ܓܘܠ . ٧٢٠٠ ܓܘܠ] × ١٠ ^-٦

ܦܣܩܐ ܫܒܝܥܝܐ

ܟܗܪܒܝܘܬܐ ܕܪܕܝܐ ܬܪܝܨܐ

Electricity of direct current

> ܕܪܟ ܡܬܘܦܐ ܒܢܝܪܐ ܦܗܘܡܐ
> ܕܘܪܫܬܐ ܕܛܥܢܐ ܟܗܪܒܝܐ
> ܐܡܝܢܐ، ܘܐܝܟܐ ܚܠܝܒ ܢܪܟܬܐ
> ܕܛܥܢܐ ܟܗܪܒܝܐ ܐܡܝܢܐ
> ܘܡܠܘܠܘܬܐ ܕܥܢܝܢܗ ܘܥܠ
> ܟܘܪܝܐ ܟܗܪܒܝܐ ܘܗܘܟܠܗ
> ܘܐܢܒܢܘܬܐ ܕܐܫܕܬܐ ܕܟܘܪܝܐ
> (ܢܣܝܩܘܬܐ، ܗܒܘܗܘܬܐ،
> ܣܒܝܟܬܐ) ܘܕܪܟ ܗܘܟܠܐ
> ܕܚܝܠܐ ܪܟܘܦܐ ܟܗܪܒܝܐ
> ܘܦܘܪܥܢܐ ܕܟܘܡܢܐ، ܘܡܦܠܚ
> ܢܡܘܣܐ ܕ(ܐܘܡ) ܘ (ܟܝܪܟܗܘܦ)
> ܘܢܠܦ ܡܫܚܬܐ ܟܗܪܒܝܬܐ
> ܘܡܘܡܩܐ ܕܛܥܢܐ

٧ ـ ١ ܛܥܢܐ ܟܗܪܒܝܐ

٧ ـ ٢ ܟܘܢܫܐ ܕܛܥܢܐ
ܘܡܫܘܚܬܐ ܕܟܢܫܗ

٧ ـ ٣ ܡܠܘܠܘܬ ܟܘܢܫܐ ܕܛܥܢܐ
ܘܐܪܘܦܠܘܬ ܠܪܘܦܐ

٧ ـ ٤ ܢܡܘܣ ܐܘܡ

٧ ـ ٥ ܗܘܟܠܐ ܕܟܘܪܝܐ

٧ ـ ٦ ܚܒܘܪܐ ܡܟܒܒܪܢ ܥܠ ܟܘܪܝܐ
ܟܗܪܒܝܐ ܕܡܬܚܠܦܢܐ ܫܘܪܝܐ

٧ ـ ٧ ܟܘܪܝܐ ܡܬܚܠܦܐ ܘܟܘܪܝܐ ܗܒܘܒܬܐ

٧ ـ ٨ ܐܫܕܬܐ ܕܟܘܪܝܐ

٧ ـ ٩ ܠܠܚܢܘܡܒܟܪ ܡܪ ܠܚܐ ܡܘܢܚܠܐ

٧ ـ ١٠ ܐܡܒܟܪ

٧ ـ ١١ ܒܘܠܬܡܒܟܪ

٧ ـ ١٢ ܡܫܚܬܐ ܕܟܘܪܝܐ ܒܡܦܠܚܬܐ ܕܒܘܠܬܡܒܟܪ ܘܐܡܒܟܪ

٧ ـ ١٣ ܡܫܚܬܐ ܕܟܘܪܝܐ ܒܡܦܠܚܬܐ ܕܡܢܝܟܪܬܐ ܕܘܝܬܣܬܘܢ

٧ ـ ١٤ ܗܘܡܢܐ ܕܐܡܒܟܪ

٧ ـ ١٥ ܢܡܘܣ ܕܓܘܪܬܐ ܕܓܝܪܬܐ

٧ ـ ١٦ ܡܫܚܬܐ ܕܚܝܠܐ ܟܗܪܒܝܐ ܪܟܘܦܐ

٧ ـ ١٧ ܡܫܚܬܐ ܕܟܘܪܝܐ ܠܡܢܐ ܕܡܟܒܘ ܟܐ

٧ ـ ١٨ ܐܘܪܚܬܐ ܕܐܫܕܬܐ ܕܟܢܬܐ

٧ ـ ١٩ ܢܡܘܣܐ ܕܟܝܪܟܗܘܦ

٧ ـ ٢٠ ܫܟܚܬܐ ܕܡܫܚܬܐ ܟܗܪܒܝܬܐ

٧ ـ ٢١ ܫܟܚܬܐ ܕܡܘܡܩܐ ܕܛܥܢܐ ܘܟܝܠܐ ܕܡܘܡܩܐ ܟܗܪܒܝܐ

(٧ - ١) ܪܕܝܐ ܕܟܗܪܒܐ Electreal Current

ܪܕܝܐ ܕܟܗܪܒܐ ܝܠܗ ܡܢ ܙܘܥܐ ܕܛܥܘܢܬܐ ܟܗܪܒܝܬܐ ܚܕܬܐ ܓܘ ܡܘܨܠܢܐ ܘܐܝܟ ܡܕܥܐ ܪܕܝܐ ܕܡܘܨܠܢܘܬܐ ܒܡܬܟܐ ܕܗܘܝ ܛܥܘܢܬܐ ܚܕܬܐ ܘܝܠܗܘܢ ܟܕܒܐ ܐܠܟܬܪܘܢܝܬܐ ܚܠܘܦܐ ܒܠܫܘܢ ܐܝܟ ܓܘ ܡܘܨܠܢܐ ܚܕܪܝܐ ܘܡܬܚܐ ܕܗܘܝ ܛܥܘܢܬܐ ܚܕܬܐ ܓܘ ܟܕܪܐ ܐܠܟܬܪܘܢܝܬܐ ܐܢܝܐ ܚܠܘܦܐ ܘܐܢܝܐ ܫܘܡܐ ܒܟܪܝܐ ܕܗܘܝ ܛܥܘܢܬܐ ܚܕܬܐ ܒܗܘܝܐ ܡܘܨܠܢܐ ܐܢܝܐ ܚܠܘܦܐ ܘܐܢܝܐ ܫܘܡܐ ܘܐܠܟܬܪܘܢܐ ܐܝܟ ܓܘ ܕܠܡܐ ܦܠܙܐ

ܐܢ ܦܬܠܚ ܣܢܝܩܐ ܙܘܥܐ ܕܪܕܝܐ ܟܗܪܒܐ ܒܝܘܟܐ ܕܙܘܥܐ ܕܛܥܘܢܬܐ ܚܕܬܐ ܒܥܠܡܐ ܟܬܘܒܐ ܕܡܣܝܒܐ ܕܝܘܟܐ ܕܪܕܝܐ ܓܘ ܒܕܐ ܘܗܘܝܐ ܡܘܨܠܢܐ ܠܠܦܐ ܟܗܪܒܐ ܒܗܝ ܛܥܘܢܬܐ ܫܘܡܐ ܘܛܥܘܢܬܐ ܚܠܘܦܐ ܙܠܚ ܒܥܒܪ ܝܘܟܐ ܦܩܚܐ ܒܗܘ ܕܐܝܬ ܒܝܬܐ ܕܛܥܘܢܬܐ ܚܠܘܦܐ ܡܢ ܓܘ ܡܘܨܠܢܐ ܒܝܘܟܐ ܡܥܣܩܐ ܥܡ ܡܟܒܝܢܘܬܐ ܕܛܥܘܢܬܐ ܫܘܡܐ ܡܟܢܝܐ ܒܝܘܟܐ ܦܩܚܐ ܒܗܘ ܕܐܝܬ ܐܝܟ ܡܕܥܐ ܙܘܥܐ ܕܛܥܘܢܬܐ ܫܘܡܐ ܓܘ ܡܘܨܠܢܐ ܒܝܘܟܐ ܡܥܣܩܐ ܒܫܡܐ ܪܕܝܐ (Conventional Current) ܘܙܘܥܐ ܕܐܠܟܬܪܘܢܐ ܓܘ ܡܘܨܠܢܐ ܚܕܪܝܐ ܗܘܐ ܒܝܘܟܐ ܦܩܚܐ ܠܝܘܟܐ ܕܫܡܐ ܪܕܝܐ.

(٧ - ٢) ܟܡܝܘܬܐ ܕܪܕܝܐ ܕܟܗܪܒܐ

ܐܝܟ ܡܬܚܙܝܐ ܪܕܝܐ ܕܝܠܗ ܟܡܝܘܬܐ ܕܛܥܘܢܬܐ ܟܗܪܒܝܬܐ (ܫ) ܕܥܒܪܬܐ ܡܢ ܓܘ ܡܩܛܥܐ ܕܡܘܨܠܢܐ ܒܚܕܝܘܬܐ ܕܙܒܢܐ ܘܝܠܗ ܡܢ ܟܡܝܘܬܐ ܠܐ ܝܘܟܐ.

$$\text{ܠ} = \frac{\text{ܫ}}{\text{ܙ}} \qquad (٧ - ١)$$

$$\text{ܘܐܝܟ ܟܝܠܐ ܪܕܝܐ ܒܚܕܝܘܬܐ} = \frac{\text{ܟܘܠܘܡܒ}}{\text{ܪܦܦܐ}}$$

ܘܟܝܠܐ ܡܥܒܕܐ ܚܕܝܘܬܐ ܕܪܕܝܐ ܒܐܡܦܝܪ ܠܫܘܡ ܐܡܦܝܪ ܐܡܦܝܪ. ܘܐܝܟ ܡܬܚܙܝܐ ܐܡܦܝܪ ܕܝܠܗ ܪܕܝܐ ܦܠܛܐ ܡܢ ܥܒܪܬܐ ܕܛܥܘܢܬܐ ܟܗܪܒܝܬܐ ܡܢ ܓܘ ܡܩܛܥܐ ܕܡܘܨܠܢܐ ܟܡܝܘܬܐ ܚܕ ܟܘܠܘܡܒ ܒܚܕ ܪܦܦܐ.

ܘܐܝܬ ܫܡܐ ܡܢܘܬܐ ܕܐܡܦܝܪ ܡܢܝܗ:

١ ܡܝܠܝ ܐܡܦܝܪ = $١٠^{-٣}$ ܐܡܦܝܪ.

(٧ - ٣) ܠܦܐ ܕܙܪܡܐ ܘܐܪܘܠܘܬܐ ܕܓܪܘܦܐ

Eletric Current Drift Speed

ܩܠܝܠܘܬܐ ܕܠܦܐ ܕܙܪܡܐ ܝܠܗ̇ ܩܠܝܠܘܬܐ ܕܟܬܝܐ ܗ̇ܝ ܥܒܘܪܐ ܕܙܪܡܐ ܡܢ ܚܕ ܡܥܒܪܢܐ. ܘܐܪܘܠܘܬܐ ܕܓܪܘܦܐ ܝܠܗ̇ ܐܪܘܠܘܬܐ ܕܐܠܩܛܪܘܢܐ ܚܕܐ ܡܢ ܓܘ ܡܥܒܪܢܐ ܘܡܬܚܫܒܠܗ̇ ܒܝܕ ܘܡܫܘܚܬܐ ܡܫܘܚܬܢܐ ܕܩܠܝܠܘܬܐ ܕܠܦܐ ܕܙܪܡܐ ܟܠܗ̇ ܝܠܗ̇ ܪܒܐ ܐܝܟ ܩܠܝܠܘܬܐ ܕܒܗܝܪܐ ܕܠܠܐ ܕܙܘܥܝܬܐ ܕܡܫܚܠܦ ܡܢ ܩܠܝܠܘܬܐ ܕܒܗܪܐ ܕܝܠܗ ٣ × ١٠ [٨] ܡܝܬܪܐ ܒܪܦܦܐ ܒܚܕ ܕܩܝܩܐ ܥܒܘܪܐ ܕܙܪܡܐ ܒܝܢ ܒܩܠܝܠܘܬܐ ܕܒܗܪܐ. ܐܠܐ ܗܘܝܐ ܐܪܘܠܘܬܐ ܕܓܪܘܦܐ ܕܟܘܚܢܐ ܚܕܐ ܡܢ ܓܘ ܡܥܒܪܢܐ ܝܬܝܪܐ ܒܨ ܓܦܦܐ ܐܪܘܠܘܬܐ ܕܓܪܘܦܐ ܕܐܠܩܛܪܘܢܐ ܓܘ ܚܕܐ ܫܪܝܬܐ ܡܓܪܘ (١) ܡܠܝܡܝܬܪܐ ܡܪܒܥ ܒܗ ܠܦܐ ܕܙܪܡܐ ܕܡܢܝܐ (١) ܐܡܦܝܪ ܝܠܗ ٩،٤ × ١٠ [-٥] ܡܝܬܪܐ ܒܪܦܦܐ ܘܒܗܕ ܠܫܢܐ ܐܣܪܐ ܩܐ ܓܪܦܬܐ ܕܐܠܩܛܪܘܢ. ܚܕ ܡܠܝܡܝܬܪܐ ܒܡܪܒܥ ܝܬܝܪܐ ܒܡܢܝܢܐ ١٠ [١] ܕܩܝܩܐ. ܒܚܕ ܕܝܗܐ ܘܐܦ ܕܐܢܐ ܚܙܝܢܢ ܒܝܢ ܐܪܘܠܘܬܐ ܕܓܪܘܦܐ ܘܩܠܝܠܘܬ ܥܒܘܪܐ ܕܗܘܡܦܐ ܕܙܪܡܐ.

(٧ - ٤) ܢܡܘܣ ܐܘܡ Ohm's Law

ܡܘܚܫܠܗ ܝܕܥܢܐ ܐܘܡ ܫܢܬܐ ١٧٢٦ ܡ ܕܦܫܝܡܘܬܐ ܒܝܢ ܦܘܪܫܐ ܕܟܘܚܢܐ ܥܠ ܬܪܘܢ ܫܘܦܐ ܕܡܥܒܪܢܐ ܘܠܦܐ ܙܪܡܢܐ ܠܗܘ ܝܠܗ ܒܫܝܘܬܐ ܡܬܚܬܐ ܡܘܕܥܢܐ ܒܡܬܚܘܡ ܕܪܓܐ ܕܫܝܫܘܬܐ. ܦܝܫܠܗ ܡܕܝܬܐ ܒܟܘܪܝܐ ܕܡܥܒܪܢܐ

$$\text{ܟܘܪܝܐ} = \frac{\text{ܦܘܪܫܐ ܕܟܘܚܢܐ}}{\text{ܠܦܐ}} \qquad \text{ܟܘ} = \frac{\text{ܦ}}{\text{ܠ}} \quad \dots\dots\dots (٧ — ٢)$$

ܘܦܝܫܠܗ ܡܕܝܬܐ ܐܫܘܬܐ ܠܟܠ ܚܡܫ. ܐܘܡ ܠܟܘܪ ܝܕܥܢܐ ܐܘܡ ܒܕ ܟܘܪܐ

ܦ ܠܦܘܪܫܐ ܕܟܘܚܢܐ ܥܠ ܬܪܘܢ ܫܘܦܐ ܕܟܘܪܝܐ ܒܡܫܚܬܐ ܒܒܘܠܛ.

ܠ ܠܦܐ ܙܪܡܢܐ ܒܟܘܪܝܐ ܒܡܫܚܬܐ ܒܐܡܦܝܪ.

ܟܘ ܠܟܘܪܝܐ ܒܡܫܚܬܐ ܒܐܘܡ.

ܐܘܡ : ܝܠܗ ܟܘܪܝܐ ܕܡܥܒܪܢܐ ܕ. ܦܝܫܠܗ ܡܘܬܒܐ ܥܠ ܬܪܘܢ ܫܘܦܘ ܦܘܪܫܐ ܕܟܘܚܢܐ ܚܕ ܒܒܘܠܛ ܒܗܘܐ ܠܦܐ ܙܪܡܢܐ ܠܗܘ ܚܕ ܐܡܦܝܪ.

ܘܡܢ ܥܦܝܦܐ ܕܐܘܡ ١ ܟܝܠܘܐܘܡ = $١٠^{٣}$ ܐܘܡ

١ ܡܝܓܐ ܐܘܡ = $١٠^{٦}$ ܐܘܡ

ܘܦܬܠܘ ܣܘܓܐܐ ܕܡܢܗ. ܐܘܡ ܠܐ ܗܘܐ ܡܫܪܝܐ ܐܠܐ ܒܫܡܫܘܬܐ ܕܦܪ̈ܫܐ ܕܚܫܚܘܬܐ ܘܡܬܚܘܪܐ ܒܪ̈ܝܫܐ ܐܚܪ̈ܢܐ ܐܝܟ ܚܠܘܙܝܐ ܘܡܫܚܠܦܬܐ. ܘܗܘܐ ܡܫܪܝܐ ܠܩܢܘܢܐ ܕܐܘܡ ܡܢ ܠܦܐ ܒܗܕܪ̈ܐ ܐܘ ܡܫܚܠܦܢܐ ܣܦܪ̈ܐ. ܘܐܝ ܦܬܠܘ ܕܫܡܫܐ ܐܫܦܪܐ ܕܢܕܐܬܐ ܒܝܢ ܒܘܠܛܝܘܬܐ ܘܠܦܐ ܒܗܘܢܐ ܡܩܝܡܬܐ ܡܢܝܬܐ ܥܠ ܚܙܝܐ ܡܫܪܝܐ ܐܝܟ ܒܨܘܪܬܐ (٧ - ١ ܐ). ܒܪܡ ܕܐܝܬ ܗܘܐ ܡܘܕܥܐ ܕܐܝܬ ܡܫܚܠܦܢܐ ܡܫܬܐ ܕܡܘܠܐ ܘܚܠܐ ܥܠ ܐܕܫܐ ܕܗܘܠܐ ܒܡܬܚܐ ܕܫܡܫܘܬܐ ܕܚܫܚܘܬܐ. ܐܠܐ ܡܢܗ. ܐܘܡ ܠܐ ܠܒܫ ܥܠ ܟܠܗܘܢ ܡܫܚܠܦܢܐ ܡܐ ܕܦܘܫܩܐ ܙܡܝܪܐ ܐܠܡܢܗܪܐ ܡܫܘܦܠܐ ܐܝܟ ܕܐܫܦܪܐ ܒܝܢ ܒܘܠܛܝܘܬܐ ܘܠܦܐ ܠܐ ܗܘܐ ܚܙܝܐ ܐܝܟ ܒܨܘܪܬܐ (٧ - ١ ܒ).

ܨܘܪܬܐ (٧ — ١ ܐ)
ܡܫܚܠܦܢܐ ܣܦܪ̈ܐ. ܐܣܛܘܬܐ ܚܙܝܬܐ

ܨܘܪܬܐ (٧ — ١ ܒ)
ܙܡܝܪܐ ܡܫܘܦܠܐ. ܐܣܛܘܬܐ ܠܐ ܚܙܝܬܐ

(٧ - ٥) ܫܘܒܠܐ ܕܟܘܪ̈ܐ

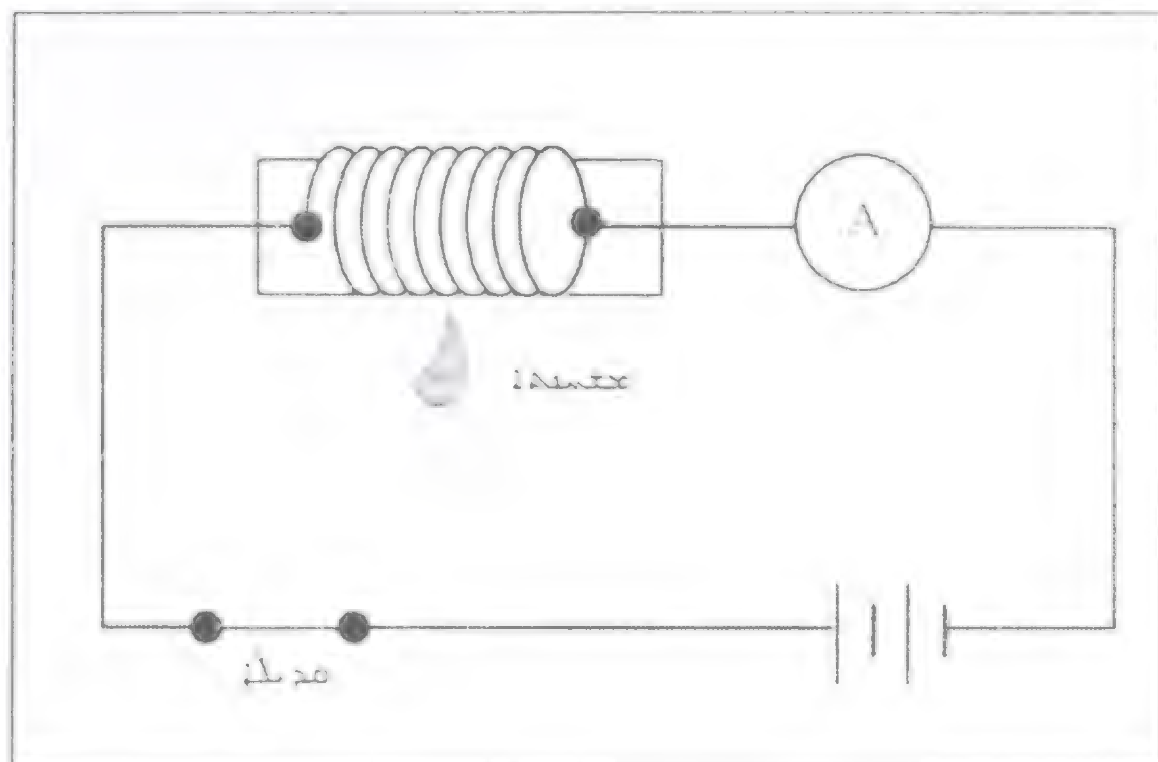
ܡܠܬܐ ܠܡܢܗ. ܐܘܡ ܗܘܐ ܟܘܪ̈ܐ ܕܗܕܪ̈ܐ ܦܫܝܛܬܐ ܒܝܢ ܦܘܪ̈ܫܐ ܕܡܘܬܪ̈ܐ ܥܠ ܥܕܘܝܐ ܗܘܦܐ ܕܡܫܚܠܦܢܐ ܘܠܦܐ ܚܕܪ̈ܢܐ ܐܢܘܢ ܒܕܝܠܐ ܕܫܡܫܘܬܐ ܡܕܥܢܝܬܐ. ܚܕܒ ܟܘܪ̈ܐ ܡܫܚܠܦܢܐ ܠܥܒܕܬܐ ܕܒܘܛܢܬܐ ܕܗܕܪ̈ܐ ܡܢ ܐܢܘܢ ܐܝܟ ܟܘܪ̈ܐ ܐܠܐ ܒܡܠܬܐ ܕܐܢܦܬܐ ܕܒܘܛܢܬܐ ܡܩܝܡܐ ܒܢܬܕܐ ܕܠܒܫܐ ܕܐܘܡܐ ܐܫܘܫܐ ܘܕܘܫܬܐ ܐܣܪܐ ܐܘ ܡܫܚܠܦܢܐ ܒܪܡ ܕܐܝܬ ܗܘܡܐ ܗ ܡܘܦܩܐ

ܕܒܚܘܢܬܐ ܡܘܒܠܢ̈ܐ ܡܘܟܝܒ ܘܟܠܠܐ ܒܝܘܪܬܐ ܐܚܪ̈ܢܝܬܐ ܡܢ ܗܘܡܦܐ ܐܝܟ ܚܡܝܡܘܬܐ ܘܗܕܐ. ܟܕ ܗܘܝܐ ܕܡܘܒܠܢ̈ܐ ܐ. ܢܣܒܠܗ ܕܪ̈ܓܐ ܕܚܡܝܡܘܬܗ ܟܘܪ ܢܚܬܐ ܕܕܪ̈ܓܐ ܕܚܡܝܡܘܬܐ ܡܟܝܪ ܡܢ ܩܠܘܠܘܬ ܕܠܘܚܝܐ ܕܝܢܬܪܐ ܘܗܘܐ ܟܝܪܐ ܡܝܢܘܬܐ ܕܠܟܦܬܐ ܕܐܠܟܬܪܘܢܐ ܒܗ.

(٧ - ٦) ܥܠܬ̈ܐ ܡܫܟܚܢ̈ܐ ܥܠ ܚܘܪ̈ܐ ܕܩܘܪ̈ܒܐ ܠܡܘܒܠܢ̈ܐ ܚܫܡ̈ܠܐ

١ - ܕܪ̈ܓܐ ܕܚܡܝܡܘܬܐ :

ܐ. ܦܟܠܘ ܠܦܬܐ ܚܕ ܡܚܕܪܐ ܡܢ ܬܐܠܐ ܕܦܪܙܠܐ ܢܚܫܝܐ ܣܦܪ ܡܛܠܬܐ ܡܢ ܐܡܘܡܐ ܘܦܟܠܘ ܐܡܪܐ ܬܐܠܐ ܠܐܡܕܪ ܒܠܬܪܐ ܘܡܕܠܐ (ܨܘܪܬܐ ٧ - ٢).



ܨܘܪܬܐ (٧ — ٢)

ܐܘ ܕܟܕܪܐ ܕܪܘܪܐ ܕܩܘܪܒܐ ܘܡܟܚܝܢܐ ܕܬܐܠܐ ܥܠ ܠܘܚܐ ܕܟܡܬܐ ܚܘܝܚ ܕܠܦܐ ܐܘ ܪܘܪܐ ܕܩܘܪܒܐ ܟܝܪ ܡܢ ܕܡܣܘܐ ܘܚܕܪܐ ܕܚܘܪ̈ܐ. ܚܘܪ̈ܐ ܕܥܠܘܗ ܣܦܪܐ ܓܦܐ ܡܘܒܠܢ̈ܐ ܘܚܕ ܒܢܚܬܐ ܕܕܪ̈ܓܐ ܕܚܡܝܡܘܬܐ ܘܟܝܢܐ ܡܢ ܕܐܗܐ ܟܕܟܘ. ܟܕ ܟܝܪ ܚܘܝܚܘ ܒܢܚܬܐ ܕܕܪ̈ܓܐ ܕܚܡܝܡܘܬܐ. ܐܝܬ ܐܡܪܐ ܚܕܡܪܐ ܢܡܚܬܐ ܐܝܟ ܡܒܠܝܚ ܘܡܘܢܡܬܢܐ. ܗܘܐ ܚܘܝܚܘ ܡܬܝܬܐ ܘܟܠܐ ܐܟܕܒ ܒܟܠܦܬܐ ܕܚܡܝܡܘܬܐ. ܟܘܕ ܕܐܗܐ ܦܟܝ ܡܬܘܪܐ ܚܘܪ̈ܐ ܡܬܘܚܬܢ̈ܐ ܡܬܝܬܐ ܕܟܘܠܐ ܡܢ ܕܐܬܐ ܢܡܚܬܐ.

٢ - ܝܘܪܟܐ :

ܚܦܦܬܐ ܕܝܘܪܟܐ ܕܬܐܠܐ ܒܬܚܘܬܗ ܠܟܘܪܐ ܐܣܕܢܐ ܟܟܡ ܟܝܪ ܠܦܐ ܠܦܠܓܐ ܠܦܘܪ̈ܢܐ ܕܟܘܟܢܐ ܡܬܚܒܐ. ܟܘܕ ܕܐܗܐ ܐܦ ܚܘܝܚ ܚܦܦ. ܚܦܦܬܐ ܕܝܘܪܟܐ

ܡܚܫܒ ܠܟܦܦܬܐ ܕܡܫܢܝܐ ܕܐܠܟܬܪܘܢܐ ܕܐܬܐ ܒܗ ܐܠܟܬܪܘܢ. ܐܢܐ ܒܚܕܘܗ
ܒܐܬܪܐ ܒܘܟ ܕܐܗܐ ܠܘܚܐ ܦܝܫ ܡܬܩܝܡ ܥܡ ܡܘܕܝܐ ܕܡܐܬܐ ܒܗ :

$$\frac{ܠܘ١}{ܠܘ٢} \qquad \frac{ܡܕ١}{ܡܕ٢}$$

٣ . ܦܘܫܩܐ ܕܡܩܘܒܠܢܘܬܐ ܦܠܘܫܬܐ :

ܐܢ ܦܬܠܘ ܐܘܟܕܐ ܐܬܐ ܕܠܘܚܐ ܒܝܢ ܫܘܦܐ ܕܬܪܬܝܢ ܦܬܠܘ ܐܘܟܕܐ ܚܕܢܘ ܒܡܫܘܚܬܐ ܐܬܐ ܕܡܫܢܝܐ ܠܡܫܘܚܐ ܚܠܝܦܐ ܐܝܟ ܠܦܐ ܒܘܫܐ ܒܬܪܝܢ ܐܢܘ ܐܬܘܗܝ ܐܬܐ ܘܗܘܐ ܠܦܐ ܚܠܝܦܐ ܚܕܦܐ ܕܠܦܐ ܚܕܕܐ ܐܢܘ ܡܢ ܐܬܐ. ܒܘܟ ܕܐܗܐ ܠܘܚܐ ܕܐܬܘܗܝ ܐܬܐ ܚܕ ܡܕܝܐ ܠܘ ܦܠܓܐ ܕܠܘܚܐ ܕܐܬܐ ܠܣܘܕܐ ܐܝܟܢ ܕܦܬܠܘ ܦܘܫܩܐ ܕܡܩܘܒܠܢܘܬܐ ܦܠܘܫܬܐ ܡܕܪܫܐ ܡܢ ܐܬܘܗܝ ܐܬܐ ܚܦܐ ܕܡܩܘܒܠܢܘܬܐ ܦܠܘܫܬܐ ܒܝܢ ܐܬܐ ܘܡܣܘܪܐ ܠܘܢܐ ܠܘܚܐ ܕܡܩܘܒܠܢܘܬܐ ܦܝܫ ܘܦܠܝܛܐ ܚܕ ܦܘܫܩܐ ܕܡܩܘܒܠܢܘܬܐ ܦܠܘܫܬܐ ܒܡܬܚܘܡ ܕܚܫܘܒܐ ܐܝܟܢܐ.

$$ܠܘ١\ ܦܫ١ = ܠܘ٢\ ܦܫ٢$$

٤ . ܐܕܫܐ ܕܗܘܠܐ :

ܐܢ ܐܫܟܚ ܒܡܫܘܚܬܐ ܐܬܐ ܐܬܐ ܒܘܫܐ ܒܡܘܕܝܐ ܘܡܩܘܒܠܢܘܬܐ ܦܠܘܫܬܐ ܚܕ ܚܕ ܡܢ ܦܪܙܠܐ ܘܐܚܪܢܐ ܡܢ ܢܚܫܐ ܘܐܫܟܚ ܚܕ ܠܚܕ ܚܕܘ ܐܘܟܕ ܡܢ ܚܕ ܐܕܫܐ ܘܐܫܟܚܢ ܠܫܘܦܐ ܕܬܪܬܝܢ. ܐܢܐ ܕܟܕܪܐ ܕܒܘܕܐ ܕܡܕܬܚܐ ܒܣܘܚ ܕܠܦܐ ܚܕܕܐ ܐܢܘ ܢܚܫܐ ܒܟ ܕܬܐ ܚܠܘ ܡܢ ܠܦܐ ܚܕܕܐ ܒܦܪܙܠܐ ܒܦܪܡܫ ܡܢ ܕܐܗܐ ܕܗܘܠܐ ܚܠܦ ܒܠܘܚܝܫ. ܒܡܕܝܢܐ ܒܚܠܦܬܐ ܕܐܕܫܐ ܕܗܘܠܐ.

ܘܡܬܩܪܝܐ ܗܠܝܢ ܐܕܫܐ ܕܚܫܘܒܐ ܡܚܒܕܢܐ ܒܠܘܚܐ ܕܡܕܝܢܐ ܒܒܕܝܐ ܡܬܚܫܒܐ ܕܡܫܡܫܘܬܐ ܒܗܘܠܬܐ ܕܐܬܐ :

$$ܠܘ \propto \frac{ܡܕ١}{ܡܕ٢}$$

ܣܘܪܓܕܐ (٧ ـ ١)

ܗܘܠܐ	ܠܘܚܐ ܐܕܫܝܐ (ܐܘܡ . ܡܝܬܪ)
ܐܠܡܢܝܘܡ	٢.٨ × ١٠ ⁻٨
ܟܪܒܘܢ	٣٥٠٠ × ١٠ ⁻٨
ܢܚܫܐ	١.٧ × ١٠ ⁻٨
ܦܪܙܠܐ	١٠ × ١٠ ⁻٨
ܙܝܒܩ	٩٤ × ١٠ ⁻٨
ܗܐܡܐ	٢.٨ × ١٠ ⁻٨
ܬܘܢܓܣܛܢ	٥.٥ × ١٠ ⁻٨

ܟܘ = ܟܘܪܐ × ܡܕ١ / ܡܕ٢   (٧ — ٣)

ܟܕ ܟܘ ܟܘܪܐ ܕܡܫܚܠܦܢܐ ܒܥܡܝܕܐ ܬܐܘܡ.

ܡܕ ܡܢܝܢܐ ܕܗܐܠܐ ܒܥܡܝܕܐ ܩܕܡܝܬܐ ܐܘ ܡܥܠܢܝܬܐ.

ܟܝ ܟܝܫܘܬܐ ܕܡܫܚܠܦܢܐ ܦܐܘܢܐ ܒܥܡܝܕܐ ܩܕܡܝܬܐ ܡܥܠܢܝܬܐ ܡܦܩܢܝܬܐ ܐܘ ܡܦܩܢܝܬܐ ܡܦܩܢܝܬܐ.

ܟܘܐ ܟܘܪܐ ܐܪܙܢܐ ܕܡܫܚܠܦܢܐ.

ܘܦܝܫ ܡܫܢܝܢܐ **ܟܘܪܐ ܐܪܙܢܐ** ܕܗܘܠܐ ܕܠܗ ܟܘܪܐ ܕܡܫܚܠܦܢܐ ܡܢ ܕܐܗܐ ܗܘܠܐ ܢܘܪܝܐ ܚܪܝܢܘ ܚܪܝܢܘܬܐ ܕܢܘܪܝܐ ܘܟܝܫܘܬܐ ܕܡܫܚܠܦܢܘ ܚܪܝܢܘܬܐ ܕܟܝܫܘܬܐ ܘܚܪܝܢܘܬܗ ܠܐ ܐܘܬ ܡܥܠܬܐ ܘܠܝܟ ܟܘܪܐ ܐܪܙܢܐ ܒܠܩܬܐ ܕܐܪܙܐ ܕܗܘܠܐ ܘܡܬܒܥܒ ܟܘܪܐ ܐܪܙܢܐ ܕܗܘܠܐ ܒܠܩܬܐ ܕܪܕܠܐ ܕܫܡܫܘܬܐ ܘܡܘܪܕܐ (٧ - ١) ܡܚܘܐ ܟܘܪܐ ܐܪܙܢܐ ܕܗܘܠܐ ܦܪܝܫܐ ܒܪܕܠܐ ٢٠.

(٧ - ٧) ܟܘܪܐ ܡܫܬܠܚܦܐ (ܐܪܙܘ ܡܬܢܕܢܝܐ) ܘܟܘܪܐ ܩܒܝܥܬܐ

ܟܠ ܡܫܚܠܦܢܐ ܡܚܘܐ ܟܘܪܐ ܒܘܪܕܢܐ (resistance) ܦܝܫ ܡܕܢܐ (resistor) ܘܐܝܬ ܬܪܝܢ ܓܢܣܐ ܐܪܙܐ ܡܢ ܟܘܪܐ.

١ . ܟܘܪܐ ܩܒܝܥܬܐ.

٢ . ܟܘܪܐ ܡܫܬܠܚܦܐ .

١ . **ܟܘܪܐ ܩܒܝܥܬܐ** :

ܗܕܐ ܟܘܪܐ ܩܒܝܥܬܐ ܝܢ ܡܢ ܗܐܠܐ ܕܟܘܪܐ ܐܝܟ ܢܩܝܒܬܐ ܕܝܒܕܘܗ ܝܒܠ ܡܕܘܗ ܐܘ ܢܩܝܒܬܐ ܕܟܘܢܩܘܕܐ. ܘܡܫܘܝ ܐܝܬ ܐܪܙܐ ܡܢ ܢܩܝܒܬܐ ܒܟܘܪܝܗ ܒܠܐ ܦܫܘܛܐ ܠܗܐܠܐ ܕܝܬܐ ܡܢ ܓܘܦܐ ܒܕ ܡܚܐ ܒܘܠܐ ܕܐܗܐ ܐܪܙܐ ܡܢ ܟܘܪܐ ܒܡ ܡܢܘܬܐ ܕܐܘܗ ܘ ٢٥٠٠٠ ܐܘܗ ܘ٣ ܒܠܘ ܐܘܗ ܐܠܐ ܐܪܙܐ ܐܚܪܢܐ ܠܗ ܟܘܪܐ ܒܟܘܢܝܐ ܘܪܒܒ ܡܢ ܡܠܟܐ ܡܢ ܡܘܒܠܐ ܕܝܠܝܠ ܘܡܕܒܘ. ܦܝܫ ܐܡܪܐ ܒܗܕܝ ܡܫܚܠܦܢܐ ܘܦܝܫ ܒܕܝܠܐ ܒܟܘܦܐ ܡܚܐ ܟܘܪܝܗ ܒܡ ܚܪܒܥܐ ܐܘܦܐ ܠܚܫܒܐ ܡܠܘܢܐ ܐܘܗ ܘܐܝܬ ܬܪܝܢ ܟܘܪܐ ܦܝܫ ܡܬܘܕܥܐ ܦܪܝܫܝܬ ܠܒܘܦܐ ܒܘܕܬܐ ܕܗܘܕܢܐ ܐܝܟ ܕܠܐ ܒܫܠܦ ܒܫܠܩܬܐ ܕܪܕܠܐ ܕܫܡܫܘܬܐ ܘܠܐ ܒܠܘܡܕܐ ܕܟܘܪܐ ܘܠܐ ܒܠܩܐ ܢܒܕܢܐ ܒܘ ܐܝܟ ܟܘܪܐ ܡܬܘܕܥܐ ܡܢ ܙܒܢܐ ܕܡܕܒܘ. ܐܘ ܙܒܢܐ ܕܐܘܒܕ ܕܫܦܪܐ.

٢ - ܟܘܪ̈ܐ ܡܫܚܠܦ̈ܐ :

ܘܒܠܘ ܟܘܪ̈ܐ ܗܕܟܝܐ ܙܝܕ ܟܠܘ ܡܬܕܟܝܢ̈ܐ ܕܟܕܝܕ ܠܦ̈ܐ ܟܦܘܡ̈ܐ ܡܢܘ ܐܨܘܪܬܐ (٧ - ٣) ܘܐܝ ܦܝܫܠܘ ܐܫܝܪܐ ܟܘܪ̈ܐ ܒܡܘܪ̈ܬܐ ܕܡܪܟܒܬܐ ܒܝܢ ܬܪ̈ܘܝܗܝ ܢܘܩܙ̈ܐ ܐ . ܒ ܟܕܝܕ ܠܦ̈ܐ ܟܦܘܡ̈ܐ ܒ ܐ. ܦܝܫܠܘ ܐܫܝܪܐ ܒܡܘܪ̈ܬܐ ܕܡܪܟܒܬܐ ܒܝܢ ܬܪ̈ܘܝܗܝ ܢܘܩܙ̈ܐ ܐ . ܓ ܟܕܝܕ ܠܦ̈ܐ ܟܦܘܡ̈ܐ ܒ ܓ . ܘܐܝ ܟܘܫܠܦܠܘ ܟܘܦܐ ܕܡܬܕܟܝܢ̈ܐ ܕܟܫܠܬ ܟܘܪ̈ܐ ܕܟܘܪ̈ܐ ܠܟܘܡ ܕܐܘܐ.

ܐܨܘܪܬܐ (٧ - ٣)

(٧ - ٨) ܐܫܪ̈ܬܐ ܕܟܘܪ̈ܐ

ܦܝܫܝ ܐܫܝܪܐ ܟܘܪ̈ܐ ܒܨܒܥܘ̈ܬܐ ܐܘ ܒܡܢܝܢܘ̈ܬܐ ܐܘ ܐܫܪ̈ܬܐ ܣܦܝܪ̈ܬܐ.

١ - ܐܫܪ̈ܬܐ ܕܟܘܪ̈ܐ ܒܨܒܥܘ̈ܬܐ :

ܗܕܟܐ ܐܫܪ̈ܬܐ ܕܨܒܥܘ̈ܬܐ ܐܝܟ ܕܦܝܫܝ ܐܫܝܪܐ ܗܕܟ ܟܘܪ̈ܐ ܐܘ ܝܗܒܐ ܦܘܦܐ ܠܦܘܦܐ ܠܗ ܕܘܪ̈ܬܐ ܕܡܪܟܒܬܐ ܐܝܟܐ ܕܦܝܫܐ ܚܕ ܐܘܪܚܐ ܡܢ ܠܦ̈ܐ ܕܡܪܟܒܬܐ ܐܝܟ ܒܐܨܘܪܬܐ (٧ - ٤).

ܒ - ܠܦ̈ܐ ܟܕܝܕ̈ܐ ܒܕܘܪ̈ܬܐ ܕܨܒܥܘ̈ܬܐ :

ܒܟܠܝ ܕܠܗ ܕܘܪ̈ܬܐ ܕܨܒܥܘ̈ܬܐ ܐܝܬ ܚܕ ܐܘܪܚܐ ܟܠܫܘܕ ܠܟܕܝܬܐ ܕܠܦ̈ܐ ܘܐܗܐ ܗܘܟܠܘ ܒܠܘ ܕܠܦ̈ܐ ܟܢܕܘ ܟܕܝܕ ܡܢ ܠܗ ܟܠܝܗ ܟܘܪ̈ܐ ܕܕܘܪ̈ܬܐ ܘܐܝ ܦܝܫܠܘ ܐܫܝܪܐ ܐܨܝܕܐ ܒܟܘܠܡ̈ܐ ܕܟܠ ܟܘܪ̈ܐ ܒܕܘܪ̈ܬܐ ܕܨܒܥܘ̈ܬܐ ܟܠܝܗ ܐܨܝܕܐ ܒܟܫܘܝ ܠܦ̈ܐ ܟܢܕܘ ܟܕܝܕ ܟܟܠ ܟܘܪ̈ܐ. ܘܐܝܟ ܗܕܟܐ ܐܝܫܘܬܐ ܗܡܕܪܫܬܐ ܠܗܘܐ ܐܢܐ ܒܕ ܠܦ̈ܐ ܟܢܕܘ ܟܕܝܕ ܟܟܠ ܗܘܡ̈ܐ ܡܢ ܕܘܪ̈ܬܐ ܕܨܒܥܘ̈ܬܐ ܟܡܘ ܕܐܗܐ ܟܠ ܗܘܡ̈ܐ ܦܝܫ ܐܫܝܪܐ ܟܐܗܐ ܕܘܪ̈ܬܐ ܗܠܐ ܕܗܘܐ ܡܢܝܢ̈ܐ ܟܠ ܡܢܝܢ̈ܬܐ ܕܠܦ̈ܐ ܒܕ ܕܟܐ ܕܠܐ ܣܕܪ̈ܬܐ. ܘܐܝ ܒܕܐܠܘ ܡܢܝܢ̈ܬܐ ܟܠܝܗܐ ܕܣܕܪ̈ܬܐ ܒܝܢ ܡܢ ܕܐܝܢ ܟܘܪ̈ܐ ܒܫܠܝܬܐ ܟܕܝܕ̈ܬܐ ܕܠܦ̈ܐ ܠܗ ܕܘܪ̈ܬܐ.

ܒ. ܒܘܠܛܢܘܬܐ ܠܗ ܕܘܪܬܐ ܕܢܩܦܘܬܐ :

ܐ. ܦܬܠܘ ܐܫܪܐ ܒܘܠܛܢܝܐ ܠܡܘܦܩ ܕܟܠ ܚܘܝܐ ܒܕܘܪܬܐ ܕܢܩܦܘܬܐ ܠܟܠܗܐ ܕܦܘܪܫܐ ܕܚܘܝܐ ܒܝܢ ܣܘܦܐ ܕܟܠ ܚܘܝܐ ܘܡܘܦܩܠ ܦܘܪܫܐ ܕܚܘܝܐ ܒܟܠܗ ܚܘܝܐ ܒܝܚܝܕ ܕܝܗܘܐ ܒܘܠܛܢܘܬܐ ܟܠܝܬܐ ܡܣܡܟܬܐ ܠܚܝܠܬܐ ܕܚܘܝܐ ܐܫܪܐ ܒܢܩܦܘܬܐ . ܗܢܐ ܘܒܝܢ

ܦ = ܦ١ + ܦ٢ + ܦ٣

ܓ. ܚܘܝܐ ܠܘܡܟܠܬܐ ܒܕܘܪܬܐ ܕܢܩܦܘܬܐ :

ܒܡܫܠܡܬܐ ܒܡܘܠܬܐ ܦ = ܦ ١ + ܦ ٢ + ܦ ٣ + ...

ܡܢ ܓܒܪ ܥܠ ܦ = ܠ ܚܘ   ܡܢ ܩܢܘܢ ܐܘܡ

ܠ ܚܘ ܠܘܡܟܠܬܐ = ܠ ܚܘ١ + ܠ ܚܘ٢ + ܠ ܚܘ٣ + ..

ܘܦܠܓܬܐ ܕܓܕܘܫ ܡܘܦܩ ܥܠ ܠ . ܒܦܠܓ

ܚܘ ܠܘܡܟܠܬܐ = ܚܘ١ + ܚܘ ٢ + ܚܘ٣ + ...   (٧ — ٤)

ܗܢܐ ܘܒܝܢ :

ܚܘܝܐ ܠܘܡܟܠܬܐ ܠܚܝܠܬܐ ܕܚܘܝܐ ܐܫܪܐ ܒܢܩܦܘܬܐ ܟܘܐ ܒܡܢܝܢܐ ܕܟܠ ܚܘܝܐ

ܐܨܘܪܬܐ (٧ — ٤) : ܐܫܪܐ ܕܢܩܦܘܬܐ

٢. ܐܫܪܐ ܕܚܘܝܐ ܒܡܫܘܘܬܐ :

ܦܬܚ ܐܫܪܐ ܒܝܢ ܬܪܝܢ ܢܘܩܙܐ (ܐ ، ܒ) ܦܘܪܫܐ ܕܚܘܝܐ ܒܢܬܗܘܢ ܫܘܝܐ ܐܝܟ ܕܒܨܘܪܬܐ (٧ - ٥) ܘܒܐܗܐ ܗܘܐ ܠܟܠ ܚܘܝܐ ܡܢ ܚܘܝܐ ܐܫܪܐ ܒܡܫܘܘܬܐ ܦܘܪܫܐ ܕܚܘܝܐ ܒܢܬܗ ܥܠ ܡܘܦܩ.

ܨܘܪܬܐ (7 ـ 5) : ܐܣܪܬܐ ܕܡܩܒܠܘܬܐ

2 ـ ܒܘܠܛܢܘܬܐ ܒܐܣܪܬܐ ܕܡܩܒܠܘܬܐ :

ܡܢ ܕܒܠܝܬܐ ܕܐܣܪܬܐ ܒܡܩܒܠܘܬܐ ܕܦܘܪܫܢܐ ܕܡܘܬܪܐ ܗܘܐ ܒܘܪܐ ܚܕ ܠܐܘܚܕܐ ܢܡܘܣܐ (2 ـ ܒ) ܨܘܪܬܐ (٧ - ٥) ܗܘܝܐ ܡܢܗ : ܦ١ = ܦ٢ = ܦ٣. ܘܟܠ ܕܐܝܟ ܐܝܟ ܐܢܐ ܚܙܝܢ ܕܡܘܬܪܐ ܒܘܪܟܐ ܕܦܬܐ ܐܣܪܐ ܒܐܝܟ ܐܢܫܘܬܐ ܘܠܐ ܕܦܬܐ ܡܘܬܪܐ ܕܦܠܓ ܥܠܗ ܒܦܘܪܫܢܐ ܕܡܘܬܪܐ ܒܢܬܗ ܘܠܗ ܥܒܕܗ ܦܬܐ ܡܘܬܪܐ ܠܫܠܡܐ ܕܒܝܬܐ ܒܒܘܠܛܢܘܬܐ ܢܦܝܫܬܐ ܒܘܠܛ ٢٢٠ ܒܘܠܛ ܘܠܐ ܦܬܐܘ ܐܣܪܐ ܡܘܬܪܐ ܦܠܓ ܥܠ ١١٠ ܒܘܠܛ ܒܫܘܚܠܦ ܒܗܘ ܕܐܝܟ ܐܢܐ ܘܠܐ ܢܕܥܬܐ ܕܒܘܠܛܢܘܬܐ ܕܡܘܬܪܐ ܡܢܗ ܐܣܪܬܗ ܒܕܘܪܬܐ.

ܒ ـ ܠܦܝ ܓܘ ܕܘܪܬܐ ܕܡܩܒܠܘܬܐ :

$ܠ = ܠ_1 + ܠ_2 + ܠ_3$

ܓ ـ ܡܘܬܪ ܓܘ ܕܘܪܬܐ ܕܡܩܒܠܘܬܐ :

ܡܫܚܠܦܬܐ ܡܬܘܡܬܐ

$$ܠ = ܠ_1 + ܠ_2 + ܠ_3 + \ldots$$ ܡܢ ܓܝܪ ܟܠ ܗ $= \dfrac{ܦ}{ܡܗ}$ ܚܘܝܢ ܕ

$$\dfrac{ܦ}{ܡܗ\ ܠܘܩܒܠܐ} = \dfrac{ܦ}{ܡܗ_1} + \dfrac{ܦ}{ܡܗ_2} + \dfrac{ܦ}{ܡܗ_3}$$ ܒܦܠܓܬܐ ܥܠ ܦ ܒܦܠܛ

$$\frac{١}{\text{ܡܩ ܠܘܩܒܠܝܐ}} = \frac{١}{\text{ܡܩ١}} + \frac{١}{\text{ܡܩ٢}} + \frac{١}{\text{ܡܩ٣}} \ldots\ldots (٧ — ٥)$$

ܡܠܒܫܐ ܕܡܩܘܝܐ ܠܘܩܒܠܝܐ ܗ̄ܘܐ ܒܡܢܝܢܐ ܕܡܠܒܫܐ ܕܡܩܘܝܐ ܐܚܪܢܐ ܒܡܫܘܚܬܐ ܒܗܕܐ ܕܐܝܬܝܗ̇ ܗܘܐ ܡܩܘܝܐ ܠܘܩܒܠܝܐ ܪܒ، ܡܢ ܟܠ ܚܕ ܡܩܘܝܐ ܒܡܢܝܢܐ ܕܡܫܘܚܬܐ.

3 ـ 2 ـ ܐܣܪܬܐ ܡܩܒܠܬܐ:

ܒܗܕܐ ܐܣܪܬܐ ܕܡܩܘܝܡܐ ܡܩܘܝܐ ܥܠ ܕܘܟܬܐ ܒܡܫܘܚܬܐ ܘܡܩܘܝܡܐ ܐܚܪܢܐ ܒܦܣܝܩܘܬܐ ܘܦܣܩ ܡܢܐ ܒܢܒܥܐ ܕܚܫܡܠܐ (Network circuit) .

ܘܦܣܩ ܡܘܦܣܩܬܐ ܒܢܒܥܐ ܕܚܫܡܠܐ ܡܢ ܐܣܪܬܐ ܡܩܒܠܬܐ ܠܩܘܒܠ ܒܦܠܓܘܬܐ ܕܦܣܝܩܘܬܐ ܘܡܫܘܚܬܐ ܠܩܘܒܠ ܐܣܪܬܐ ܐܝܟ ܒܦܠܓܘܬܐ ܕܐܬܐ:

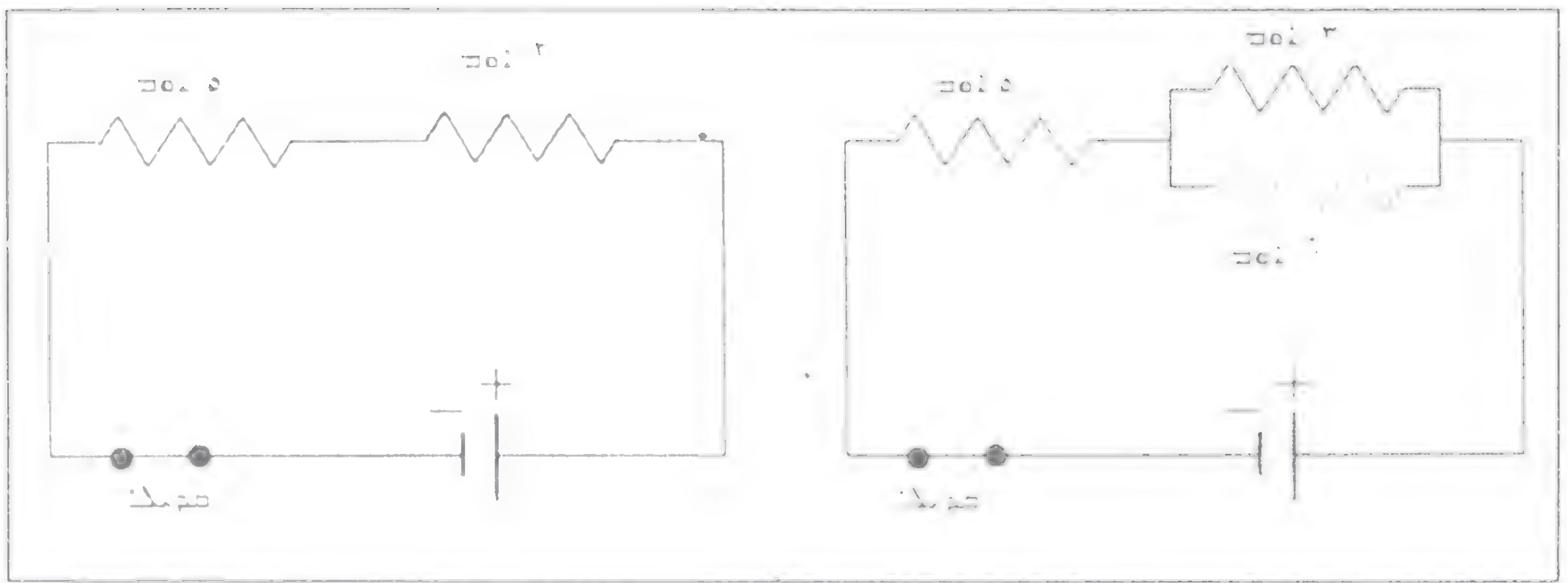
ܥܠ ܐܡܫܠܐ (٧ - ٦) ܦܣܩܬܐ ܐܣܪܬܐ ܒܝܢ ܡܩܘܝܐ ٣ ، ٦ ܐܘܡ ܒܡܫܘܚܬܐ ܘܒܝܢ ܡܩܘܝܐ ٥ ܐܘܡ ܒܦܣܝܩܘܬܐ ܠܡܚܫܒܬܐ ܕܡܩܘܝܐ ܠܘܩܒܠܝܐ ܘܠܐ ܢܒܥܐ ܕܡܫܘܚܬܐ ܒܝܢ ܡܩܘܝܐ ٣ ، ٦ ܐܘܡ ܐܣܪܐ ܒܡܫܘܚܬܐ ܒܡܩܘܝܐ ܠܘܩܒܠܝܐ ܥܠܗ

$$\frac{١}{\text{ܡܩ}} = \frac{١}{\text{ܡܩ١}} + \frac{١}{\text{ܡܩ٢}}$$

$$\frac{١}{\text{ܡܩ}} = \frac{١}{٣} + \frac{١}{٦} = \frac{٢ + ١}{٦} = \frac{٣}{٦}$$

$$\frac{١}{\text{ܡܩ}} = \frac{١}{٢}$$

ܡܩ = ٢ ܐܘܡ



ܨܘܼܪܬܵܐ (٧ — ٦ܐ) ܨܘܼܪܬܵܐ (٧ — ٦ ܒ)

ܘܗܵܫܵܐ ܡܨܝܼܚ ܡܲܣܠܸܩܬܵܐ ܕܩܸܢܝܵܢܵܐ ܝܲܕܥܵܐ ܒܦܘܼܫܵܩܵܐ ܠܡܲܟܠܵܢܘܼܬܵܐ ܠܗ ܢܬܠܐ ܠܗܿ ܟܠܘܼܢܵܐ ܠܡܲܟܠܵܢܹ̈ܐ ٢ ܐܘܗܡ ܡܘܼܡܚܝܵܢܵܐ ܥܡ ܟܠܘܼܢܵܐ ٥ ܐܘܗܡ (ܨܘܼܪܬܵܐ ٧ - ٦ ܒ. ܥܡ ܦܫ ܟܠܘܼܢܵܐ ܠܡܲܟܠܵܢܵܐ ܕܩܸܢܝܵܢܵܐ

ܟܠܘ ܩ = ٢ + ٥ = ٧ ܐܘܗܡ

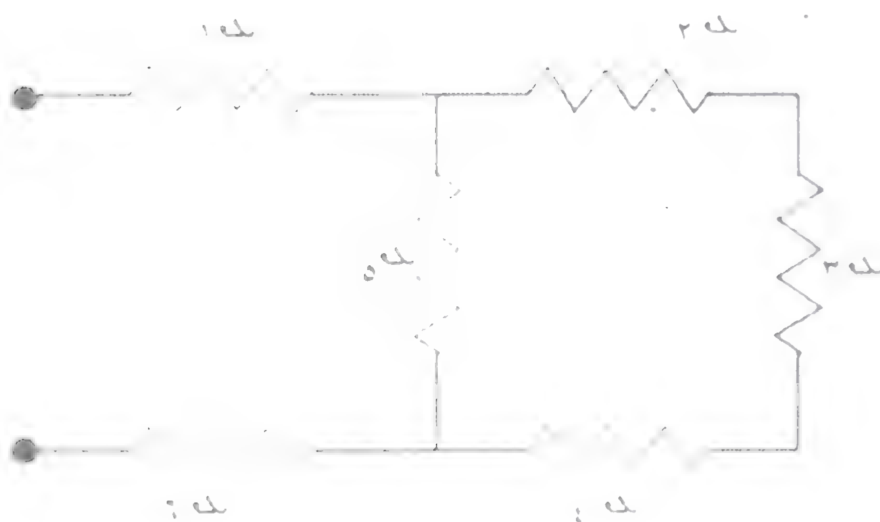
ܘܗܡ ܠܫܘܼܥܠܵܝܬܵܐ ܕܐܘܼܪܚܵܬܵܐ ܣܒܝܼܟܬܵܐ ܡܫܘܐ ܨܘܼܪܬܵܐ (٧ ـ ٧ܐ) ܚܕܘܼܬܵܐ ܕܟܠܘܼܢܵܐ ܐܘܼܪܚܵܐ ܒܩܸܢܝܵܢܵܐ ܐܝܟܐ ܕܟܠܘܼܢܵܐ ܟܠܘ٢ . ܟܠܘ٣ . ܟܠܘ٤ ܐܘܼܪܚܵܐ ܒܢܡܘܼܩܘܼܬܵܐ ܘܦܫܠܘ ܐܘܼܪܚܵܬܵܐ ܐܘܼ ܚܕܘܼܬܵܐ ܒܡܣܘܼܡܬܵܐ ܥܡ ܟܠܘܼܢܵܐ ܟܠܘ٥.

ܘܠܦܫܛܬܐ ܕܩܸܢܝܵܢܵܐ ܕܐܘܼܪܚܵܬܵܐ ܒܡܲܟܠܵܢ ܡܢ ܕܐܬܐ :

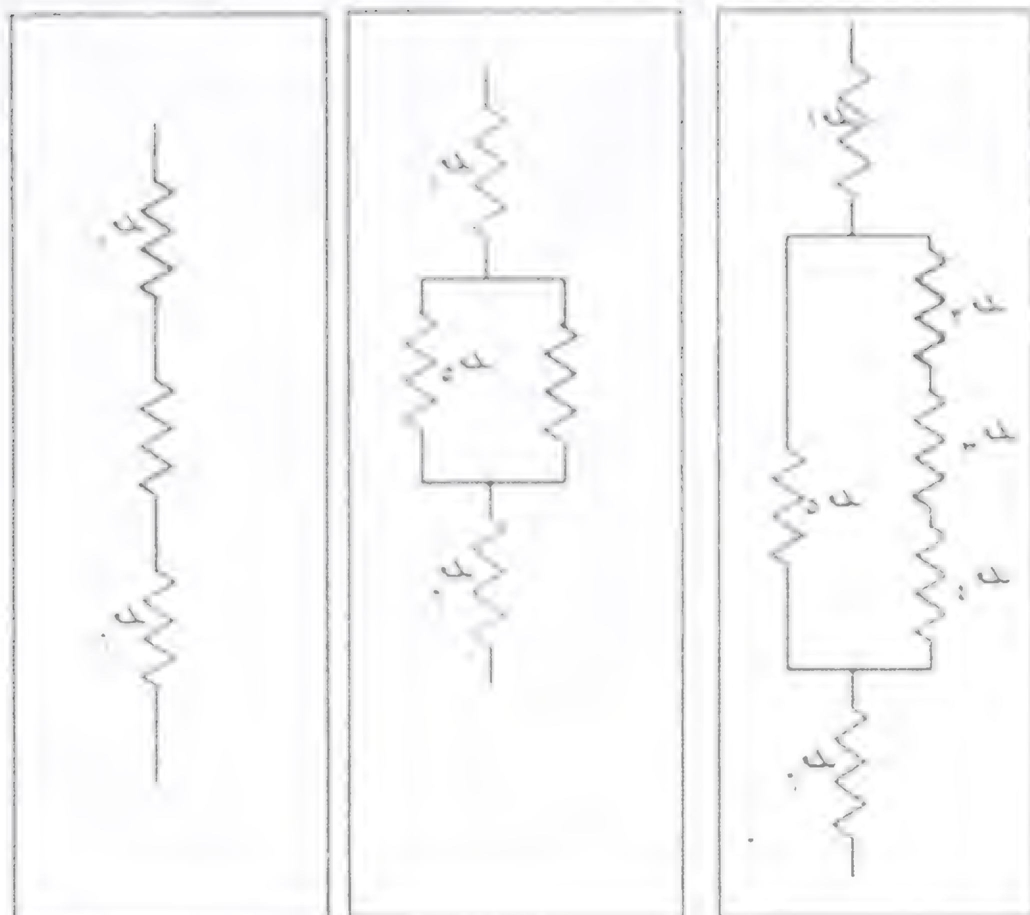
١ . ܥܡ ܦܬܐ ܕܢܡܘܼܩܘܼܬܵܐ.

ܟܠܘܐ = ܟܠܘ٢ + ܟܠܘ٣ + ܟܠܘ٤

ܐܝܟ ܒܨܘܼܪܬܵܐ (7 - ٧ܒ)



ܨܘܼܪܬܵܐ ٧ - ٧ܐ



ܨܘܪܬܐ (٧ - ٧ ܒ) ܨܘܪܬܐ (٧ - ٧ ܓ) ܨܘܪܬܐ (٧ - ٧ ܕ)

٢ . ܗܢܐ ܕܐܪܒܥܝܬܐ ܕܕܘܪܬܐ ܒܨܘܪܬܐ (٧ - ٧ ܓ) ܪܒܝܒ ܗܘܝܐ ܕܡܩܒܘܠܬܐ ܡܩ ܐ . ܡܩ٥ ܒܡܘܪܐ ܟܘܠܢܝܬܐ ܡܩ ܒ

٣ . ܒܦܝܫ ܬܚܬܐ ܐܝܟ ܒܨܘܪܬܐ (٧ - ٧ ܕ) ܐܝܟܐ ܕܗܘܐ ܡܘܪܐ ܟܘܠܢܝܬܐ ܕܬܚܬܐ

ܡܩ ܟܘܠܢܝܬܐ = ܡܩ١ + ܡܩ٢ + ܡܩ٦

(٧ - ٩) ܐܠܟܛܪܘܣܛܛܝܩ ܡܢ ܠܒܪܐ ܡܘܒܠܢܐ (G)

ܐܠܟܛܪܘܣܛܛܝܩ : ܗܘܝܐ ܦܝܫ ܡܫܘܚܠܦܐ ܠܚܝܠܐ ܘܥܠܬܐ ܕܠܒܪܐ ܡܘܒܠܢܐ ܐܝܟ ܡܫܘܚܠܦܐ ܘܥܒܕܐ ܕܬܘܬܒܐ ܘܗܘܝܐ ܒܢܝܐ ܐܠܟܛܪܘܣܛܛܝܩ ܥܠܘ ܐܝܟ ܠܗ ܐܬܪܬܐ ܕܡܢܐ ܡܢ ܗܘܝܐ ܡܘܒܠܢܐ ܕܚܝܠܐ .

ܨܘܪܬܐ (٧ - ٨) ܦܘܫ ܨܘܪܬܐ ܕܐܠܟܛܪܘܣܛܛܝܩ (G)

ܡܘܠܝܐ ܕܦܠܛܬܐ ܕܡܫܘܚܬܐ ܕܗܘܝܐ ܡܢܐ ܥܠ ܡܘܠܝܐ ܕܠܒܪܐ ܪܒܝܥܐ ܐܝܟܘ ܐ . ܗܘܐ ܠܒܪܐ ܪܒܝܥܐ ܐܝܟ ܗܘܝܐ (ܠ ܪ) ܡܩܒܠܢܐ ܦܠܛܬܐ ܕܡܫܘܚܬܐ ܕܗܘܝܐ (ܗ) ܕܐܝܬܝܗ ܒܗܘܐ :

ܠ ܪ ∝ ܗ

ܠ ܪ = ܬܐ ܠ × ܗ ..... (٧ - ٦)

ܨܘܪܬܐ (٧ — ٨) ܨܘܪܬܐ ܕܓܠܒܢܘܡܛܪܐ

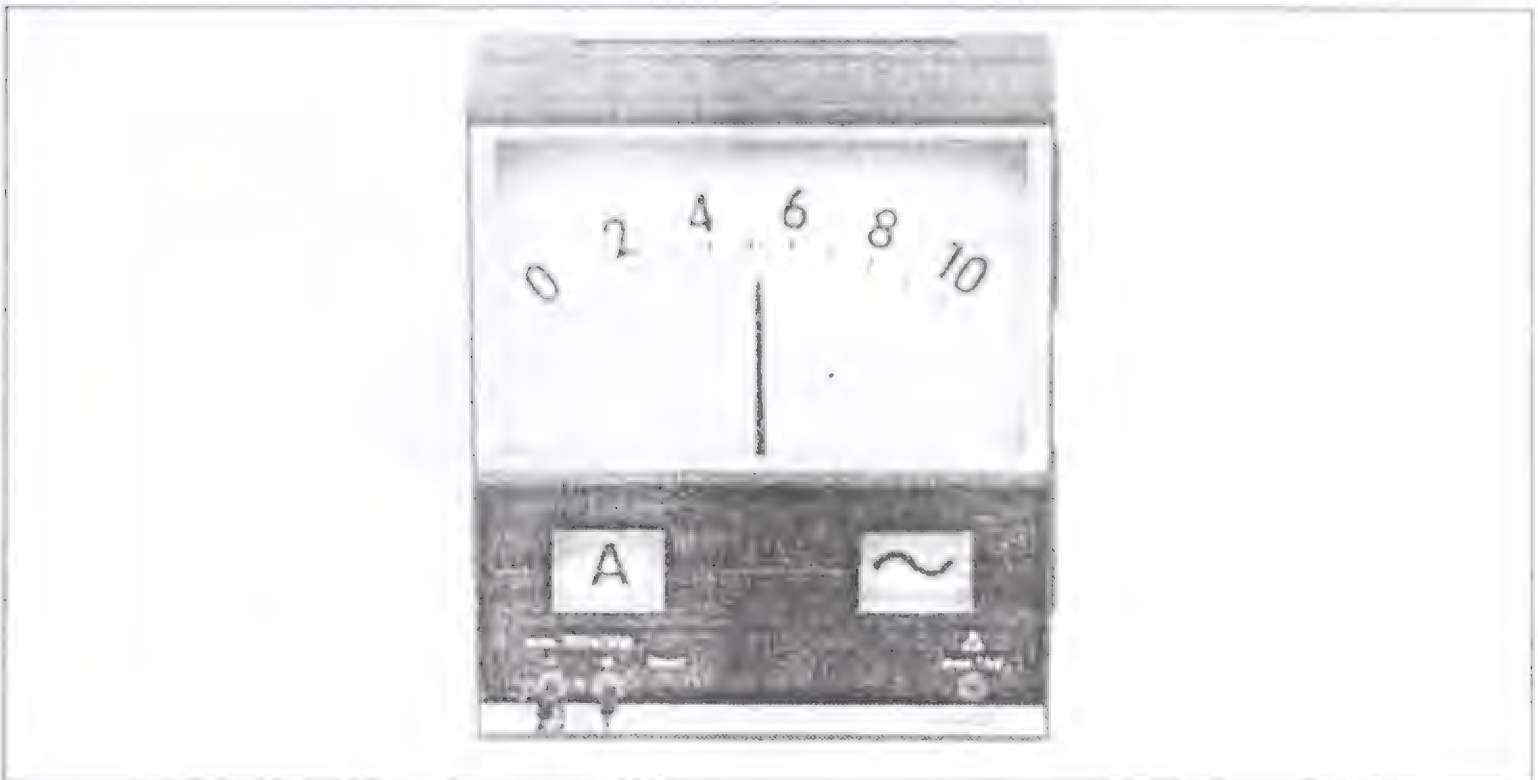
ܟܕ ܐܝܬ ܠ ܦܬܐ ܐܝܟ ܡܫܚܬܐ ܕܓܠܒܢܘܡܛܪܐ ܠܠܦܐ ܘܝܠܗ ܒܚܝܠܐ ܕܠܦܐ ܐܢܫܐ ܡܬܒܥܐ ܠܗ ܒܡܫܐ ܕܦܠܛ ܡܫܘܢܝܐ ܚܕܐ ܕܪܝܫܬܐ ܘܦܬܐ ܒܡܫܡܥܬܐ ܒܣܕܪܐ ܕܡܫܚܘܬܐ ܠܟܠ ܕܪܝܫܬܐ ܡܢ ܕܪܝܫܬܐ ܕܒܡܫܐ ܘܐܝܟ ܐܝܟ ܡܫܚܬܐ ܕܒܡܫܐ ܠܠܦܐ ܒܝܕ ܕܡܫܐ ܕܠܗܘܢ.

٤. ܡܚܠܠܦ ܐܝܟ ܡܫܚܬܐ ܕܒܡܫܐ ܒܡܫܐ ܡܬܚܬܐ ܡܦܠܚܢܐ ܠܗܘܢ ܕܪܝܫܬܗ.

(٧ - ١٠) ܐܡܝܛܪ Ameter (A)

ܐܡܝܛܪ ܝܠܗ ܡܫܐ ܦܬ ܡܦܠܚܢܐ ܠܡܟܝܠܐ ܕܠܦܐ ܠܚܘܕܐ ܦܣܩܝܐ ܕܠܐ ܝܠܗ ܡܬܚܬܐ ܒܠܚܘܕ ܒܡܦܠܚܢܐ ܕܓܠܒܢܘܡܛܪܐ ܘܦܬ ܐܡܪܐ ܒܢܣܒܬܐ ܟܕ ܡܢܬܐ ܘܦܠܐ ܕܗܘܐ ܒܪܘܫܐ ܕܐܡܝܛܪ ܘܚܘܕܐ ܐܝܬ ܒܠܚܘܕ ܟܕ ܒܪܘܫܐ ܒܠܚܘܕ ܕܒܘܪܬܐ ܕܠܐ ܡܬܒܥ ܐܘܐ ܒܚܘܝܠܐ ܕܠܦܐ ܦܠܛܐ ܒܠܚܘܕ ܒܟܕ ܐܡܝܛܪ ܘܐܬܒܥ ܐܡܝܛܪ ܡܢ ܓܠܒܢܘܡܛܪܐ ܡܟܐ ܒܪܘܫܐ ܐܡܪܐ ܒܡܟܘܢܬܐ ܟܕ ܒܪܘܫܐ ܘܚܘܕܐ ܦܬ ܫܡܐ ܡܦܠܓܢܐ (Shunt).

ܐܝܩܘܢܐ (٧ - ٩) ܦܠܛܐ ܨܘܪܬܐ ܕܐܡܦܝܪ (A)



ܐܝܩܘܢܐ (٧ - ٩) ܨܘܪܬܐ ܕܐܡܦܝܪ (A)

ܘܐܝܟ ܡܚܘܝܢܐ ܒܘܟܐ ܕܟܘܪܢܐ ܕܡܦܠܛܢܐ ܐܚܐ ܕܟܐ ܪܒܐ ܠܦܐ ܡܢ ܠܗ ܠܠܚܝܘܡܝܬܐ ܡܚܒܒ ܦܠܡܬܐ ܒܠܢܬܐ ܠܡܣܘܢܝܐ ܕܠܠܚܝܘܡܝܬܐ ܐܠܐ ܡܘܡܐ ܦܪܬܐ ܡܢ ܠܦܐ ܒܠܢܬܐ ܪܒܐ ܡܢ ܠܗ ܡܦܠܛܢܐ.

(٧ - ١١) ܒܘܠܛܡܝܬܪ Voltmeter (V)



ܐܝܩܘܢܐ (٧ - ١٠) ܨܘܪܬܐ ܕܒܘܠܛܡܝܬܪ (V)

ܒܘܠܛܡܝܬܪ ܝܠܗ ܗܘܝܢܐ ܚܝܠ ܦܘܪܫܢܐ ܕܟܘܪܢܐ ܒܝܢ ܬܪܬܝ ܢܘܩܙܐ ܠܗ ܕܘܪܬܐ ܒܘܪܟܬܐ. ܘܐܝܟ ܐܡܝܪܐ ܒܘܠܛܡܝܬܪ ܒܚܒܘܫܬܐ ܒܝܢ ܬܪܬܝܗ ܢܘܩܙܐ ܠܠܚܬܐ ܒܠܢܬܐ ܕܦܘܪܫܢܐ ܕܟܘܪܢܐ ܒܢܝܢܗ (ܠܚܡ ܟܘܪܢܐ ܠܠܚܬܐ ܒܠܢܬܐ ܕܦܘܪܫܢܐ ܕܟܘܪܢܗ).

ܪܒܝ ܒܘܠܛܡܝܬܪ ܡܢ ܠܠܚܝܘܡܝܬܐ ܡܪ ܟܘܪܢܐ ܐܡܝܪܐ ܒܢܝܦܘܬܐ ܠܡ ܟܘܪܢܐ ܠܚܘܪܐ ܡܪ ܒܘܠܐ ܠܣܡܐ ܦܝܫ ܡܪܝܐ ܟܦܦܢܐ ܕܟܘܪܢܐ (Multiplier).

ܘܦܝܫ ܡܚܘܝܢܐ ܒܡܠܬܐ ܕܟܘܪܐ ܐܚܪܢܐ ܕܐܪܐ ܠܦܝ ܚܘ ܐܬܚܪܢܘܬܐ ܡܚܒܒ ܦܠܛܐ ܚܠܝܬܐ ܠܡܣܘܝܢܐ ܐܣܝܡܐ (٧ - ١٠) ܐܝܟ ܙܘܪܐ ܕܦܘܠܛܝܬܐ (٧).

ܘܗܠܐ ܕܗܘܐ ܟܘܪܐ ܕܦܘܠܛܝܬܐ ܚܠܝܐ ܐܚܐ ܒܡܘܫܚܐ ܐܝܟ ܡܘܠܐ ܕܟܘܪܐ ܡܠܒܒܐ ܚܝܠܐ ܕܦܘܪܚܢܐ ܕܟܘܪܢܘ. ܡܐ ܕܗܘܐ ܒܘܫܠܦܐ ܒܟܘܪܐ ܠܘܡܚܠܬܐ ܠܡܘܒܢܬܐ ܕܡܣܗܘܬܐ ܘܟܘܪܐ ܐܚܐ ܐܝܟܐ ܕܗܘܐ ܡܦܝܬܐ ܒܒܡܬܗ ܡܐ ܕܒܒܡ ܠܦܐ ܪܕܝܢܐ ܒܦܟܘܐ ܕܦܘܠܛܝܬܐ ܐܚܐ ܘܟܘܪܐ ܗܘܐ ܡܦܝܬܐ ܒܒܡܬܗ. ܒܘܕ ܕܐܗܐ ܟܝܕ ܒܘܫܠܦܐ ܚܠܦܐ ܪܕܝܢܐ ܒܟܘܪܐ ܡܠܒܒܐ ܚܝܠܐ ܕܦܘܪܚܢܐ ܕܟܘܪܢܐ ܒܝܢ ܗܘܦܗ ܘܡܝܠܗ ܗܘܐ ܡܪܝܬܐ ܕܦܘܠܛܝܬܐ ܐܝܟܐ ܐܝܟ ܕܐܗܐ ܟܘܪܐ ܡܪ ܦܠܛܐ ܐܚܐ ܕܡܝܡܐ.

ܐܠܘܟܢܘܬܐ ܕܦܘܠܛܝܬܐ ܦܫܐ ܒܡܣܡܬܐ ܒܐܘܡ ܠܚܠ ܒܦܘܠܛ ܘܟܘܢܐ ܦܣܡܬܐ ܕܟܘܪܐ ܕܦܘܠܛܝܬܐ ܠܐܕ ܦܘܪܚܢܐ ܕܟܘܪܢܐ ܡܦܝܬܐ ܕܚܠܠܗ ܒܦܘܠܛܝܬܐ ܒܢܐܗ.

$$\text{ܐܠܘܟܢܘܬܐ ܕܦܘܠܛܝܬܐ} = \frac{\text{ܟܘܪܐ ܕܡܪ̈ܝܢܐ ܕܦܘܠܛܝܬܐ}}{\text{ܡܪܝܐ ܐܚܐ ܕܦܘܠܛܝܬܐ}} = \frac{\text{ܐܘܡ}}{\text{ܦܘܠܛ}} \quad \ldots (٧ - ٧)$$

ܘܡܐܕܢܐ ܗܡܚܕܢܐ ܡܢ ܝܕܥܬܐ ܕܐܗܐ ܐܠܘܟܢܘܬܐ ܝܠܗ ܝܕܥܬܐ ܕܟܘܪܐ ܕܦܘܠܛܝܬܐ ܠܐܕܝܢܬܐ ܚܠܝܬܐ ܡܣܝܥܬܐ ܘܗܝ ܝܕܥܬܐ ܗܡܚܕܢܝܬܐ ܒܡܣܝܥܬܐ ܕܐܕ ܒܡܠܬܐ ܠܟܘܪܐ ܗܘܐ ܡܦܝܬܐ ܚܠܬܐ ܕܦܘܪܚܢܐ ܕܟܘܪܢܗ ܒܐܗܐ ܦܘܠܛܝܬܐ ܒܟܝܪܘܬܐ ܦܘܪܐ.

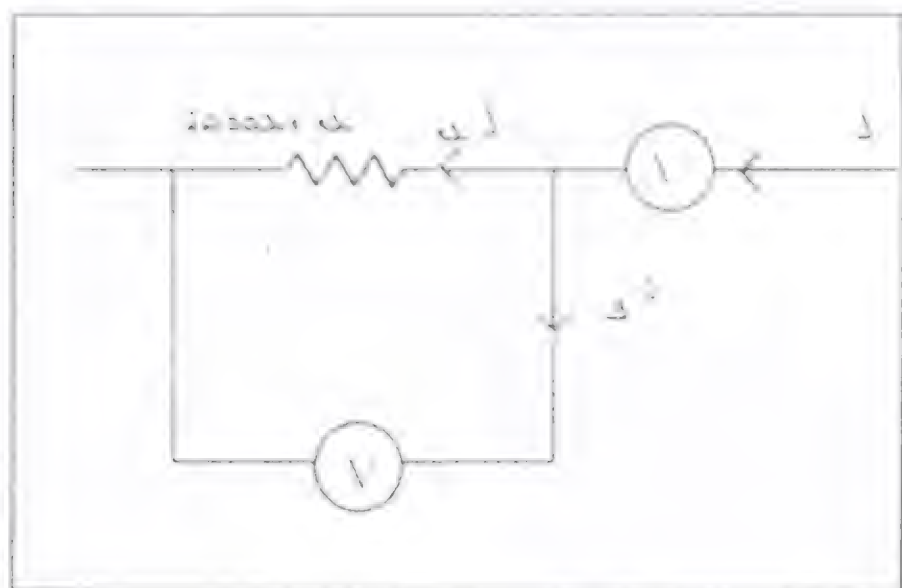
(٧ - ١٢) ܚܝܠܐ ܕܟܘܪܐ ܡܦܠܛܢܐ ܕܦܘܠܛܝܬܐ ܘܐܡܝܬܐ

ܐܚܠܐ ܐܗܐ ܐܘܪܚܐ ܕܚܠܬܐ ܕܦܘܪܚܢܐ ܕܟܘܪܢܐ ܒܝܢ ܗܘܦܐ ܕܟܘܪܐ ܒܝܕ ܦܘܠܛܝܬܐ ܘܚܠܬܐ ܕܠܦܐ ܐܚܪܢܐ ܠܗ ܒܝܕ ܐܡܝܬܐ ܘܟܡܝܬܐ ܕܡܢܘܡ ܐܘܡ

$$ܟܘ = \frac{ܦ}{ܠ} = \frac{\text{ܡܪܝܐ ܕܦܘܠܛܝܬܐ}}{\text{ܡܪܝܐ ܕܐܡܝܬܐ}}$$

ܒܗܘ ܐܘܪܚܐ ܡܫܟܚܢܬܐ ܠܐ ܝܠܗ ܡܫܢܝܬܐ ܟܠܝܬܐ ܕܦܘܠܛܝܘܬܐ ܘܠܦܐ ܕܟܗܪܒܐ ܒܡܫܘܚܬܐ ܚܕ ܡܢܝܢܐ ܐܝܟ ܕܒ ܛܠܝܒ ܠܗ ܒܝܢܐ ܗܕܐ ܐܡܫܘܬܐ :

ܐ ـ ܠܚܢܠܬܐ ܕܟܗܪܒܐ ܘܟܗܦܪܐ



ܐܡܝܬܪ (٧ - ١١)

ܦܬܚܐ ܐܡܝܬܪܐ ܕܘܪܬܐ ܐܝܟ ܒܐܡܝܬܪ (٧-١١) ܘܗܘܝܐ ܡܪܟܬܐ ܕܦܘܠܛܡܝܬܪ ܗܪܝܟܬܐ ܘܗܘ ܟܠ ܦܘܪܫܢܐ ܕܟܗܪܒܐ (ܦ) ܒܝ ܗܘܦܐ ܕܟܗܪܒܐ ܐܠܐ ܡܪܟܬܐ ܕܐܡܝܬܪ ܠܐ ܓܘܫܢܐ ܠܦܐ ܕܟܗܪܒܐ ܠܚܘܕܗ ܐܠܐ ܟܠ ܠܦܐ ܕܟܗܪܒܐ + ܠܦܐ ܕܦܘܠܛܡܝܬܪ (ܠ ܟܗ + ܠ ܦ)

ܘܒܕ ܟܗܪܒܐ ܗܘܦܐ ܘܟܗܦܪܐ ܘܟܗܪܒܐ ܕܦܘܠܛܡܝܬܪ ܟܗܦܪܐ ܘܝܠܗ ܐܡܝܬܪ ܒܡܫܘܚܬܐ ܒܗܘܝܐ ܡܫܢܝܬܐ ܚܫܚܬܐ ܠ ܦ ܠܡܟܗܪܒܘܗ.

ܒܚܕܪܐ ܦܠܓܐ ܕܦܠܓܬܐ ܕܡܪܟܬܐ ܕܦܘܠܛܡܝܬܪ ܥܠ ܡܪܟܬܐ ܕܐܡܝܬܪ ܓܘܫ ܟܗܪܒܐ ܠܡܚܠܢܐ ܠܚܘܫܬܐ ܕܡܫܘܚܬܐ.

$$\text{ܗܢܐ ܘܦܫ ܟܗ ܠܘܡܚܠܢܐ} = \frac{\text{ܡܪܢܐ ܕܦܘܠܛܡܝܬܪ}}{\text{ܡܪܢܐ ܕܐܡܝܬܪ}}$$

$$\frac{١}{\text{ܟܗ ܦ}} = \frac{١}{\text{ܟܗ}} + \frac{١}{\text{ܟܗ ܒ}}$$

ܒܕ ܓܠܝܢܐ ܡܢ ܟܠܬܐ ܕܦܠܓܬܐ ܕܟܗܪܒܐ ܝܠܗ ܘܟܗܪ ܡܢ ܟܗܪܒܐ ܚܕܝܬܐ ܘܚܡܫܐ ܕܠܗܘܢ ܟܗܪܒܐ ܓܠܝܬܐ ܟܠܬܗ ܒܡܫܘܚܬܐ ܠܟܗܪܒܐ ܕܦܘܠܛܡܝܬܪ ܒܘܝܕ ܦܘܪܐ ܡܫܢܝܐ.

ܒ ـ ܠܚܢܠܬܐ ܕܟܗܪܒܐ ܓܚܕܪܐ

ܠܐܒܐ ܓܘܫܢܐ ܡܪܟܬܐ ܕܐܡܝܬܪ ܠܦܐ ܕܟܗܪܒܐ ܒܠܚܘܕ ܗܢܐ ܘܦܫ ܠ ܟܗ ܐܠܐ ܡܪܟܬܐ ܕܦܘܠܛܡܝܬܪ ܠܐ ܓܘܫܢܐ ܦܘܪܫܢܐ ܕܟܗܪܒܐ ܟܠ ܗܘܦܐ ܕܟܗܪܒܐ ܐܠܐ ܓܘܫܢܐ ܦ ܟܗ + ܦ ܒ ܘܒܕ ܟܗܪܒܐ ܝܠܗ ܓܚܕܪܐ ܘܟܗܪܒܐ ܕܐܡܝܬܪ ܘܟܗܦܪܐ

ܘܐܝܟ ܐܡܝܪܐ ܒܢܩܝܦܘܬܐ ܦܘܪܫܢܐ ܕܚܘܝܠܐ ܟܠ ܚܘܦܐ ܕܐܡܝܪܐ ܒܗܘܐ ܘܚܘܕܐ ܡܙܝܢܬܐ ܗܠܝܢ ܒܨܘܪܬܐ ܐܝܟ ܕܒܨܘܪܬܐ (٧-١٢).

ܘܒܗܕܐ ܐܝܢܘܬܐ ܒܟܠܝܫ ܚܘܝܠܐ ܠܘܡܟܠܐ ܕܚܘܒܬܐ ܕܢܩܝܦܘܬܐ.

ܨܘܪܬܐ (٧ - ١٢)

$$ܚ\ ܠܘܡܟܠܐ = \frac{ܡܕܝܢܐ\ ܕܚܘܠܡܬܐ}{ܡܕܝܢܐ\ ܕܐܡܝܪܐ}$$

$$ܚ\ ܠܘܡܟܠܐ = ܚ_1 + ܚ_2$$

ܘܟܠܢܐ ܗܠܝܢ ܡܢܟ ܕܦܠܛܐ ܕܚܘܝܠܐ ܗܠܝܢ ܕܒ ܡܢ ܚܘܝܠܐ ܒܕܝܕܐ ܒܚܘܝܠܐ ܘܚܘܝܠܐ ܕܐܡܝܪܐ ܘܚܘܕܐ ܘܐܝܟ ܐܡܝܪܐ ܒܢܩܝܦܘܬܐ ܘܦܘܪܫܢܐ ܕܚܘܒܬܐ ܟܠ ܚܘܦܐ

(٧ - ١٢) ܡܟܝܠܬܐ ܕܚܘܝܠܐ ܒܡܦܠܚܬܐ ܕܡܥܒܪܬܐ ܕܘܝܛܣܛܘܢ. ܡܥܒܪܬܐ ܡܝܛܪܝܬܐ

ܐ - ܡܥܒܪܬܐ ܕܘܝܛܣܛܘܢ:

ܗܠܝܢ ܡܢ ܐܘܪܚܬܐ ܡܨܡܘܕܐ ܘܦܫܝܛܐ ܡܦܠܚܬܐ ܕܬܐ ܠܡܟܠܬܐ ܕܚܘܝܠܐ ܠܐ ܝܕܝܥܐ ܒܝܘܬܪܐ ܕܩܘܫܬܐ. ܗܕܐ ܡܥܒܪܬܐ ܡܢ ܒܬܚܐ ܡܢ ܐܪܒܥܐ ܡܢ ܦܠܛܘܬܐ ܘܐܪܒܥܐ ܚܘܝܠܐ ܗܠܝܢ ܡܢܗܘܢ ܚܕ ܡܙܝܢܬܐ ܗܠܝܢ ܡܬܩܠܬܐ ܕܚܘܠܡܐ ܘܐܪܒܥܐ ܦܠܛܐ ܗܠܝܢ. ܘܐܝܟ ܐܡܝܪܐ ܐܝܟ ܒܨܘܪܬܐ (٧-١٣) ܘܦܠܛܐ ܦܠܛܘܬܐ ܡܥܒܪܬܐ ܐܘ ܠܒܪܐ ܡܢ ܗܕܐ ܦܠܛܐ ܡܕܝܢܐ ܐܒ ܓ ܕ. ܘܒܐܘܪܚܐ ܦܘܬܝܐ ܠܦܐ ܦܠܛܘ ܠܗܕܐ ܦܠܛܐ ܠܐ ܒܝܘܬ ܠ ١ . ܠ ٢ ܘܒܬܩܠܬܐ ܕܒܝܘܬܐ ܕܚܘܝܠܐ ܡܙܝܢܬܐ ܗܠܝܢ ܒܨܡܕܐ ܕܠܦܐ ܚܕܪܝܐ ܒܦܠܛܘܬܐ ܒܘܐ ܦܠܛܐ ܘܦܬܐ ܐܡܝܪܐ ܕܡܥܒܪܬܐ ܗܠܝܢ ܒܐܝܢܘܬܐ ܕܚܘܦܠܐ ܘܦܬܐ ܗܕܐ ܒܝܘܬܐ ܒ ܒܚܘܒܬܐ ܒܝܢ ܐܘ ܓ ܐ ܒ - ܦܠܛܐ ܘܗܘܐ ܠܦܐ ܠ ١ ܒܝܢ ܚܕܪܐ ܒܗܕܐ ܚܘܝܠܐ ܚ١ ، ܚ٢ ܐܘ ܠܦܐ ܠ ٢ ܗܠܝܢ ܒܝܢ ܚܕܪܐ ܒܗܕܐ ܚܘܝܠܐ ܚ٣ ، ܚ٤ ܘܟܠ ܕܗܘܐ ܒܦܬܐ

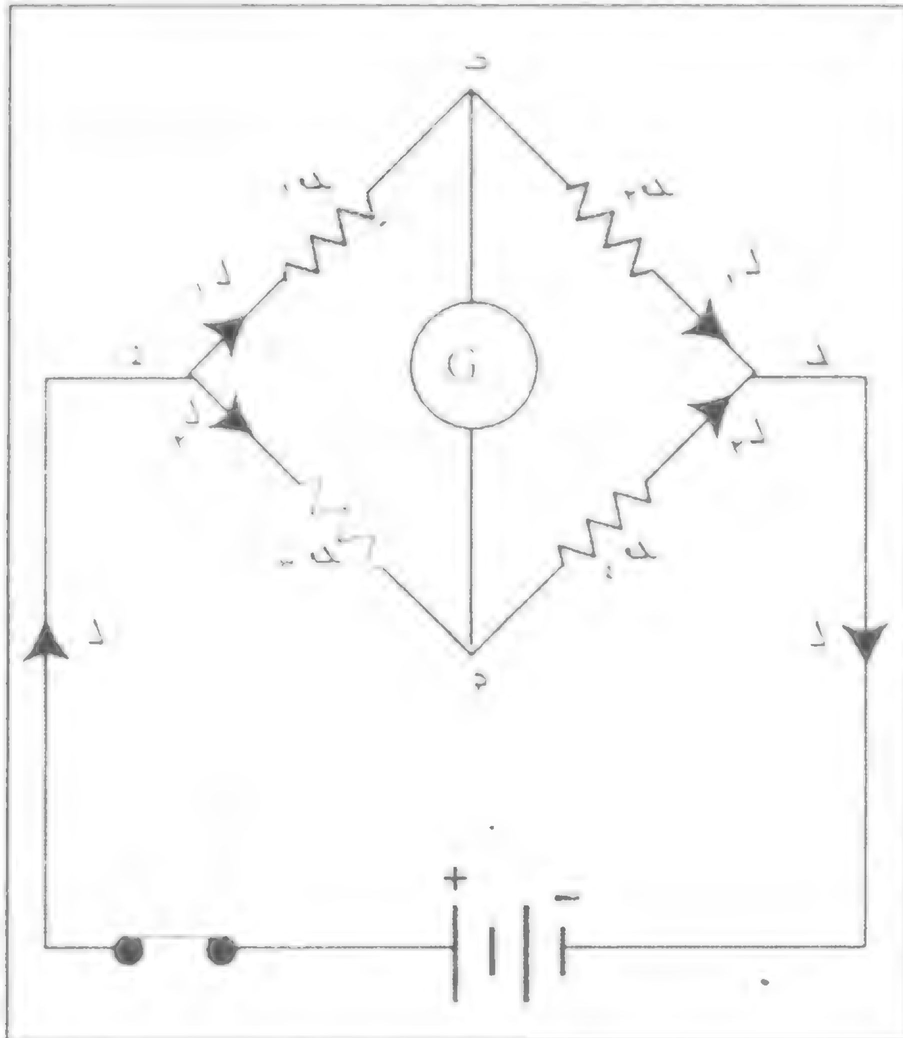
$$ܦ_{ܐܒ} = ܦ_{ܐܕ} \qquad ܘܡܢܗ \qquad ܠ_1\ ܚ_1 = ܠ_2\ ܚ_3 \ \dots (1)$$

ܦ ܐܒ = ܦ ܕܓ   ܘܡܢܗ $ܬ_1 \; ܡܘ_2 = ܬ_2 \; ܡܘ_4$ ... (٢)

ܘܒܦܠܓܬܐ ܕܗܘܡܠܬܐ ܡܕܡܝܬܐ ܥܠ ܗܕܡܝܬܐ ܒܦܠܓܗ

$$\frac{ܡܘ_1}{ܡܘ_2} = \frac{ܡܘ_3}{ܡܘ_4}$$ ... (٧ – ٨) ܡܢܘܢܐ ܕܡܬܩܕܡܬܐ

ܘܒܗ ܗܠܟܐ ܡܩܘܡܐ ܡܕܝܥܐ ܡܠܦܗ ܒܗܘܢܐ ܡܩܝܡܬܐ ܥܠܬܐ ܕܡܩܘܡܐ ܕܒܥܠܬܐ.

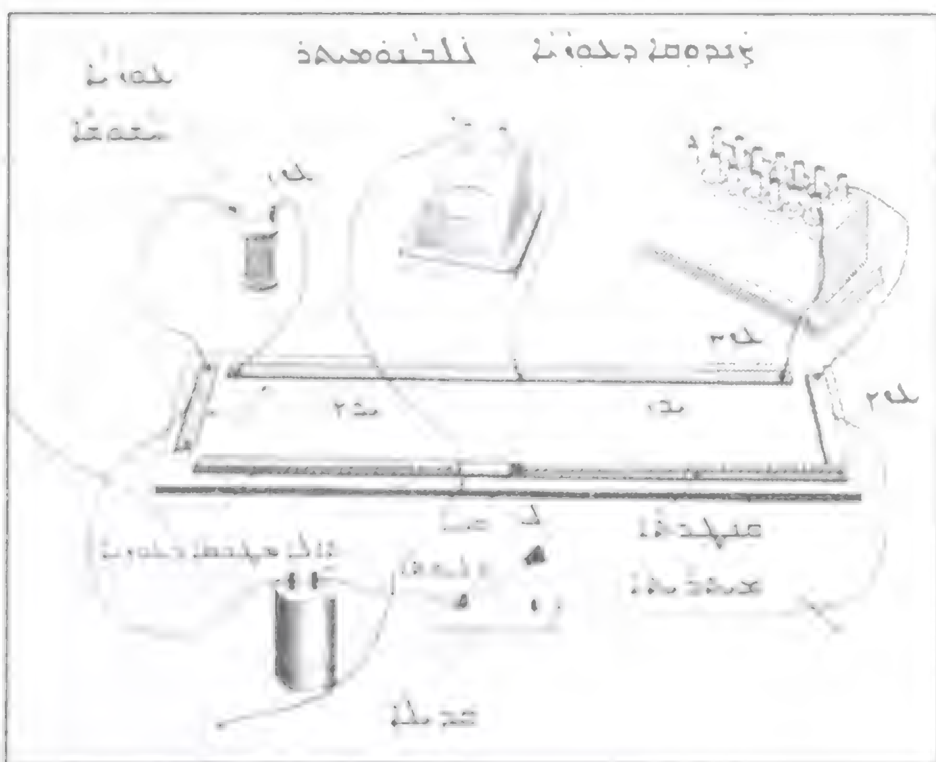


ܐܣܟܡܐ (٧ - ١٣) ܡܬܩܕܡܬܐ ܕܘܝܛܣܛܘܢ

ܒ - ܡܬܩܕܡܬܐ ܡܛܪܝܬܐ

ܘܝܠܗ ܒܘܚܠܦܐ ܕܡܬܩܕܡܬܐ ܕܘܝܛܣܛܘܢ ܘܗܕܟܐ ܡܢ ܡܩܘܡܐ ܡܕܝܥܐ ܘܐܚܪܢܐ ܫܒܘܩܐ ܘܣܝܡܐ ܡܢ ܦܐܬܐ ܕܡܩܘܡܐ ܡܛܒܥܐ ܕܡܬܚܠܦܢܐ ܗܘܝܐ ܚܕ ܡܝܬܪܐ ܐܝܟ ܒܐܣܟܡܐ (٧ - ١٤).

$$\frac{ܡܘ_1}{ܡܘ_2} = \frac{ܡܘ_3}{ܡܘ_4}$$



ܐܣܟܡܐ (٧ - ١٤) ܡܬܩܕܡܬܐ ܡܛܪܝܬܐ

$$\text{ܥܘ}_1 = \text{ܥܘ}_2 \times \frac{\text{ܥܘ}_3}{\text{ܥܘ}_4} \quad \ldots\ldots\ldots\ldots\ldots\ldots (٧ — ٩)$$

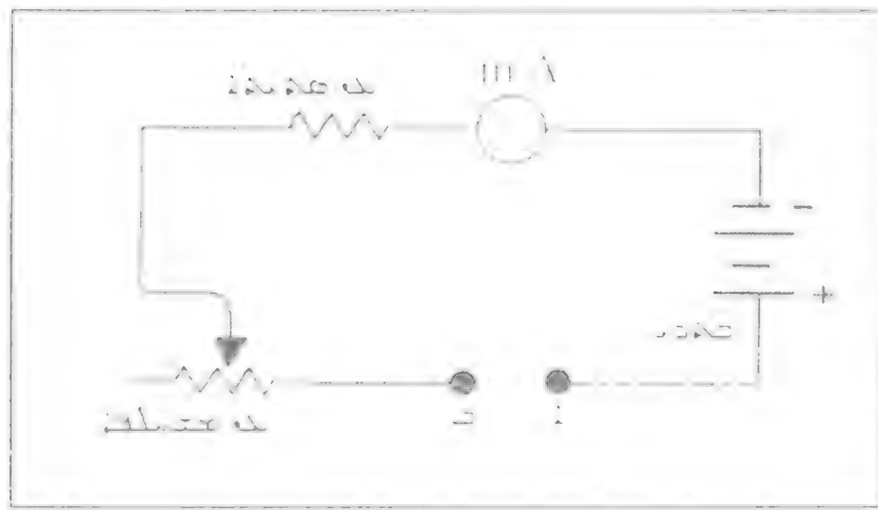
ܟܕ ܠܐ ܝܠܗ ܐܝܡܢܐ ܕܦܘܫܐ ܥܡܘܕܐ ܥܘ٣ . ܥܘ٤ ܝܕܝܥܬܐ ܐܠܐ ܦܫܘܛܐ ܥܡ ܡܘܕܥܝܢ ܬܘܬܐ ܦܫܘܛܐ ܥܡ ܐܕܘܢܝ ܥܘܪܐ ܥܘܝ ܗܘܡܐ ܡܢ ܚܕ ܐܐܠܐ ܡܢ ܐܝܢܐ ܘܡܝܬܪܐ ܕܡܝܬܪܐ ܥܡܕ ܕܐܘܡܝܛܪܐ ܝܠܗ ܐܡܠܐܐ ܕܡܝܬܪܐ ܕܟܝܠܬܐ ܕܥܘܦܐ ܕܥܡܘܕܐ ܕܠܝܬܐ ܥܡ ܐܐܠܐ ܥܠ ܕܦܫܝܛܐ ܡܪܚܩܐ ܕܠܝܬܘܡܝܛܪ ܗܝܡܢܐ ܘܥܘܕܐ

$$\frac{\text{ܥܘ}_3}{\text{ܥܘ}_4} = \frac{\text{ܡܪ}_1}{\text{ܡܪ}_2}$$

$$\text{ܥܘ}_1 = \text{ܥܘ}_2 \times \frac{\text{ܡܪ}_1}{\text{ܡܪ}_2} \quad \ldots (٧ — ١٠)$$

ܟܕ ܡܝܬܪܐ ܝܠܗ ܐܝܟܐ ܕܥܘܫܢܐ ܥܘ١ ܝܕܝܥܬܐ ܝܠܗ ܥܘ٢ ܝܕܝܥܬܐ ܘܦܝܫ ܟܝܠܐ ܟܠ ܡܢ ܡܪ١ . ܡܪ٢ ܒܡܝܬܪܐ ܗܝܡܢܐ ܒܥܘܡܩܐ ܕܡܝܬܪܐ.

(٧ ـ ١٤) ܣܘܟܡܐ ܕܐܘܡܝܛܪ



ܐܣܟܡܐ (٧ — ١٥) ܕܘܪܬܐ ܕܣܘܟܡܐ ܕܐܘܡܝܛܪ

ܐܘܡܝܛܪ : ܣܘܟܡܐ ܦܝܫ ܡܘܦܠܚܐ ܠܟܝܠܬܐ ܕܥܘܫܢܐ ܕܥܘܪܐ ܒܐܘܪܚܐ ܕܝܘܬܐ. ܘܐܬܪܐ ܕܘܪܬܐ ܕܐܘܡܝܛܪ ܡܢ ܬܐܪܝ ܡܕ ܒܠܝܫܘܬܐ ܘܥܘܪܬܐ ܥܘܫܢܐ ܗܝܡܢܐ ܘܥܘܫܢܐ ܡܫܚܠܦܐ ܘܡܠܝ ܐܡܝܬܪ (m.A) ܘܗܘܠܐ ܡܢ ܬܘܠܡܐ (ܐ . ܒ) ܠܐܣܪܬܐ ܕܥܘܫܢܐ ܫܬܦܫ ܠܒ ܦܬܝܐ ܕܐܣܠܘܡܐ ܕܕܘܪܬܐ.

ܐܦ ܕܦܘܠܚܢܐ ܕܐܘܡܢܐ ܕܐܘܡܕܢܐ ܗܡܠ ܟܠ ܚܫܠܡܬܐ ܕܐܘܡܢܐ ܕܡܠܝ ܐܡܕܐ ܠܚܘܠܐ ܕܟܘܪܝܐ ܗܘܕܪܢܐ ܚܕ ܕܪܐ ܠܚܘܕ ܡܢܗ. ܐܦ ܘܐܝܟ ܗܘܝܐ ܕܘܟܬܗ ܦܫܝܛܬܐ ܟܘܪܝܐ ܬܪܬܐ ܒܝܢ ܟܪܘܗ ܢܘܩܕܐ ܕܡܫܚܬܐ (ܐ . ܒ) ܗܘܐ ܠܐ ܢܘܠܡܢܐ. ܘܠܦܐ ܗܘܐ ܡܫܚܬܐ. ܘܪܡܙ ܡܚܘܝܢܐ ܕܐܘܡܢܐ ܠ (ܡܫܚܬܐ) ܡܠܝ ܐܡܟܝܕ ܘܐܗܘܐ ܟܐܢ ܠܐ ܢܘܠܡܢܐ ܕܐܘܢ ܠܪܕܝܬܐ ܕܚܘܠܐ ܕܟܘܪܝܐ. ܒܢ ܦܬܚ ܐܡܕܐ ܟܪܘܗ ܢܘܠܡܢܐ (ܐ . ܒ) ܚܕ ܕܪܐ ܘܡܫܠܡ ܠܟܘܪܝܐ ܡܫܠܡܬܐ ܗܠ ܕܡܢܝܚ ܟܠ ܦܠܓܬܐ ܟܠܢܝܬܐ ܠܡܚܘܝܢܐ ܕܡܠܝ ܐܡܕܐ ܦܬܐ ܕܡܚܘܬܐ ܐܗܐ ܢܘܩܕܬܐ ܟܠ ܕܪܕܝܬܐ ܒܢܝܬܐ ܡܫܚܬܐ ܕܡܚܘܝܐ ܟܠ ܟܘܪܝܐ ܬܪܐ ܡܫܚܬܐ ܐܝܟ ܕܗܘܐ ܡܚܘܝܢܐ ܒܐܗܐ ܬܘܦܐ.

ܘܗܘܐ ܐܦܠܐ ܠܗ ܡܘܢܠܗ ܟܠܢܝܐ ܕܪܐ ܕܬܘܪ ($\dfrac{\text{ܫ . ܘ . ܦ}}{\text{ܟܘܪܝܐ ܕܐܘܡܕܢܐ}}$) ܘܪܡܙ ܡܚܘܝܢܐ ܕܐܘܡܢܐ ܠ (ܡܫܚܬܐ) ܠܚܘܕ ܕܪܕܝܬܐ ܕܚܘܠܐ ܕܟܘܪܝܐ. ܘܠܐܗܐ ܗܘܐ

ܕܪܕܝܬܐ ܕܟܘܪܝܐ ܦܫܝܛܬܐ ܠܪܕܝܬܐ ܕܠܦܐ.

ܘܐܢ ܡܡܫܚܬܐ (ܐ . ܒ) ܒܟܘܪܝܐ ܬܪܬܐ (ܟܘܒ) ܬܘܪ ܐܦܠܐ ܡܢ ܡܘܢܠܗ ܟܠܢܝܐ. ܘܡܬܐ ܕܘܝܕ ܡܘܢܠܐ ܕܟܘܪܝܐ ܬܪܬܐ ܬܬܘܪ ܡܘܢܠܐ ܕܠܦܐ ܘܪܡܙ ܡܚܘܝܢܐ ܠܡܘܢܠܐ ܕܐܗܐ ܟܘܪܝܐ (ܐܨܛܠܐ ٧ ـ ١٦) ܘܗܘܝ ܕܪܕܝܬܐ ܕܐܘܡܕܐ ܠܐ ܬܗܘܐ ܒܢ ܡܕܪܒܢ ܡܬܐ ܕܘܝܕ ܡܘܢܠܐ ܕܟܘܪܝܐ (ܐܨܛܠܐ ٧ ـ ١٧).

ܐܨܛܠܐ (٧ ـ ١٦)
ܟܠܢܝܐ ܠܗ ܡܠܐܐ ܕܡܘܢܠܐ ܕܟܘܪܝܐ ܒܝܢ ܡܘܡܢܐ ܕܐܘܡܕܐ

ܐܨܛܠܐ (٧ ـ ١٧)
ܡܚܘܝܢܐ ܠܗ ܕܪܕܝܬܐ ܕܐܘܡܕܐ ܠܐ ܬܗܘܐ ܒܢ ܡܕܪܒܢ ܕܪܕܝܬܐ ܡܬܐ ܕܘܝܕ ܡܘܢܠܐ ܕܟܘܪܝܐ

ܐܝܣܡܬܐ ܗܘ ܦܘܫܟܐ ܕܐܘܡܢܐ ܕܐܦܣܗܬܐ ܡܢ ܦܩܠܣܗܘ ܒܝܕ ܡܘܪܐ ܡܚܠܦܐ (ܕܡܘܗܒܬܐ) ܒܝܕ ܚܝܠܟ ܡܘܢܠܐ ܫ . ܘ . ܚ ܕܒܬܪܒ. ܘܗܠܐ ܕܡܘܬܐ ܕܐܦܣܗܬ ܠܐ ܦܝܬ ܡܘܦܠܬܐ ܠܚܠܬܐ ܕܡܘܪܐ ܒܡܗܝܢ ܕܕܡܬܐ ܕܠܦܐ ܠܗܘ ܚܕܐܠܗ ܒܘܠܛܘܬܐ ܕܓܘܕܬܐ ܐܚܝܢܬܐ ܒܕܬܐ ܒܗܝ ܐܢܐ ܡܚܒܒ ܠܫܠܦܬܐ ܕܠܦܐ ܡܗܝܪܐ ܠܐܘܐ ܕܕ ܠܒܬܐ ܐܦ ܚܠܬܐ ܕܡܘܪܐ ܒܝܕ ܐܦܣܗܬ ܠܐ ܗܠܘ ܕܡܒܡܬܐ ܒܝܠܬܐ ܕܠܐ ܗܡܝܡܘܬܐ ܕܡܘܢܠܐ ܫ . ܘ . ܚ ܕܒܬܪܒ.

(٧ ـ ١٥) ܡܥܘܩ ܕܓܘܕܬܐ ܕܒܝܬܝܬܐ

ܒܒܕܐܠܗ ܒܠܘܚ ܒܡܝܒܠܐ ܡܦܠܛܐ ܕܓܘܕܬܐ ܒܡܪ̈ܢܝܬܐ ܐܪ̈ܙܐ ܒܐܡܡܗܘ ܦܝܠܛܐ ܡܢ ܡܚܘܬܐ ܕܚܝܠܐ ܘܡܥܘܦܐ ܕܡܪ̈ܢܝܐ ܡܡܘܪܐ ܠܘܐ ܦܝܬ ܕܡܫܐ ܒܕܡܫܐ ܡܥܘܒ ܘܦܝܬ ܐܡܒܕܐ ܠܛܒܝܢܐ ܒܕܝܢ ܡܘܪܗ ܡܥܒ ܘܡܒܠܐ ܕܡܪ̈ܢܝܐ ܠܒܒܕܬܐ ܘܦܫܣܬܐ ܕܓܘܕܬܐ. ܡܝܒܬܐ ܗܠܘ ܡܕܟܦܬܐ ܕܐܘܡܠܬܐ ܕܓܘܕܬܐ ܕܡܪ̈ܢܝܬܐ ܕܒܝܪܬܐ ܡܢ ܡܥܘܩ ܛܒܪܬܐ ܕܐܘܡܦܐ. ܒܗܝ ܚܝܠܐ ܘܡܥܘܦܐ ܕܡܪ̈ܢܝܐ ܕܡܥܘܒܐ ܗܠܘ ܐܘܡܦܐ ܕܡܡܕܒܠܗ ܡܥܘܒܐ ܠܫܕܝܘܬܐ ܕܒܣܘܢܬܐ ܕܡܪ̈ܢܝܬܐ ܘܗܠܘ ܐܘܡܦܐ ܕܡܘܒܒ ܒܕܘܕܬܐ ܕܡܪ̈ܢܝܬܐ ܒܐܡܡܢܐ ܕܒܘܠܠܐ ܦܝܬ ܙܥܦܐ ܒܛܒܝܢܐ ܘܐܫܕܢܐ ܒܡܘܪܐ ܛܘܢܐ

ܗܐ ܕܝܢ ܫ . ܘ . ܚ = ܦ + ܠ ܡܥܘܓ .... (٧ ـ ١١)

ܫ . ܘ . ܚ = ܠ ܡܥܘܒ + ܠ ܡܥܘܓ

$$\text{ܐܘ ܠ} = \frac{\text{ܫ . ܘ . ܚ}}{\text{ܡܥܘܒ + ܡܥܘܓ}} \quad \ldots\ldots (٧ ـ ١٢)$$

ܗܘܐ ܦܘܪ̈ܢܝܐ ܕܡܘܥܢܐ ܒܠ ܗܘܦܐ ܕܡܥܘܡܐ ܒܐܘܗ ܐܚܝܢܘܬܐ ܦ = ܠ ܡܥܘܒ ܒܕ ܕܡܘ ܡܥܘܒ ܠܡܘܪܐ ܒܕܝܐ

(٧ ـ ١٦) ܡܢܠܬܐ ܕܚܝܠܐ ܕܡܪ̈ܢܝܐ ܘܡܥܘܦܐ

ܠܡܢܠܬܐ ܕܚܝܠܐ ܕܡܪ̈ܢܝܐ ܘܡܥܘܦܐ ܕܒܬܪܒ ܦܝܬ ܐܡܒܕܐ ܡܘܛܒܐ ܕܒܬܪܒ ܠܒܘܠܛܡܒܕ ܐܝܟ ܛܠܢܐ ܒܐܡܡܢܐ (٧ ـ ١٨) ܘܐ. ܡܘܪܐ ܛܘܐ ܕܒܬܪܒ ܗܘܐ ܡܥܘܒ ܘܡܘܪ̈ܢܐ ܕܒܘܠܛܡܒܕ ܡܘ ܦ. ܘܡܒ ܒܘܠܛܡܒܕ ܒܠܗ ܐܘܕܢܐ

ܡܫܚܠܦܢܘܬܐ ܕܙܪܡܐ ܒܥܘܢܐ ܕܥܒܪܬܐ ܘܡܬܝܕܥܐ ܒܗ ܠܦܐ. ܡܥܘܠܝܐ ܕܠܦܐ ܡܩܝܡܬܐ ܠܗ ܡܬܚܫܒܐ :

$$ܠ = \frac{ܣ . ܢ . ܩ}{ܡܘܒ + ܡܘܒܠ}$$

ܨܘܪܬܐ (٧ ـ ١٨)

ܘܦܘܪܫܢܐ ܕܡܘܬܒܐ ܒܝܢ ܡܘܩܕܐ ܕܥܒܪܐ

ܦ = ܣ . ܢ . ܩ − ܠ ܡܘܒܠ

ܘܟܕ ܡܘܒ >> ܡܘܒܠ ܒܐܠܩܛܪܘܢ ܒܥܠ ܦܘܪܫܢܐ ܕܡܘܬܒܐ ܦ ܘܗܘܐ ܡܘܪܟܒܐ ܚܝܠܐ ܒܡܘܪܟܒܐ ܕܙܪܡܐ ܕܡܬܚܫܒܐ.

ܦܪܫܐ ܗܘܝܘ ܡܢ ܕܐܗܐ ܒܗ ܚܝܠܐ ܣ . ܢ . ܩ ܒܥܠܬܐ ܡܦܠܣܬܐ ܕܒܐܠܩܛܪܘܢ ܡܢ ܚܘܫܒܐ ܚܠܝܐ ܕܬܐ

ܘܡܢ ܗܘܝܐ ܠܥܒܪܬܐ ܐܝ ܟܕ ܡܘܬܒܐ ܠܥܒܕܐ ܕܬܐ ܐܘ ܕܙܪܡܐ ܦܫܝܛܐ ܒܗܘܐ ܦ = ܣ . ܢ . ܩ

(٧ ـ ١٧) ܚܝܠܐ ܕܡܘܪܟܒܐ ܠܘܬܐ ܕܡܬܚܫܒܐ

ܐܙܕܘܚ ܕܙܪܡܐ ܕܢܣܒܘܬܐ ܐܝܟ ܒܨܘܪܬܐ (٧ ـ ١٩) ܕܐܬܪܐ ܡܢ ܡܬܚܫܒܐ ܣ . ܢ . ܩ (ܬܘܕܝ) ܘܐܣܒܪܐ ܡܘܪܟܒܐ ܘܡܕܝܠܐ (٢) ܒܝܢ ܦܝܬ ܐܣܒܪܐ ܒܐܠܩܛܪܘܢ ܡܢ ܡܘܪܟܒܐ ܚܠܝܐ ܒܐܘܪܚܐ ܕܡܕܝܠܐ (١) ܠܗܘܦܐ ܕܡܬܚܫܒܐ.

ܨܘܪܬܐ (٧ ـ ١٩)

ܚܙܝ : ܕܒܕܝܚ ܕܙܪܡܐ ܕܒܐܠܩܛܪܘܢ ܒܝܕ ܡܕܝܠܐ (١) ܠܘܬ ܦܬܚܐ ܕܡܕܝܠܐ (٢)

ܦܠܓ̈ܐ ܘܡܫܬܟܚ ܡܫܘܚܬܐ ܕܒܘܠܛܡܝܬܪ ܘܡܫܘܚܬܗ = ܣ . ܘ . ܩ

ܗܕܐ : ܕܢܕܢܚ ܕܡܫܘܚܬܐ ܕܐܡܝܬܪ ܒܝܕ ܡܕܒܠܢܐ (٢) ܚܕ ܐܡܝܬܪܐ ܕܕܒܪܢܘܬܐ ܕܡܕܒܠܢܐ (١) ܡܫܘܚܬܐ ܕܒܘܠܛܡܝܬܪ = ܟ ܘܡܫܘܚܬܐ ܕܐܡܝܬܪ = ܠ

ܗܫܐ : ܡܫܬܟܚ ܗܘܝ ܕܒܘܪܬܐ ܕܥܒܕܬܐ ܠܥܠܬܐ ܕܚܘܝܢܐ ܓܘܢܐ.

$$ܥܘܠ = \frac{ܣ . ܘ . ܩ \quad ܟ}{ܠ}$$

$$= \frac{\text{ܡܫܘ̈ܚܬܐ ܕܒܘܠܛܡܝܬܪ ܡܕܡܝܐ} \quad \text{ܡܫܘ̈ܚܬܐ ܕܒܘܠܛܡܝܬܪ ܐܫܬܟܚܬ}}{\text{ܡܫܘ̈ܚܬܐ ܕܐܡܝܬܪ}}$$

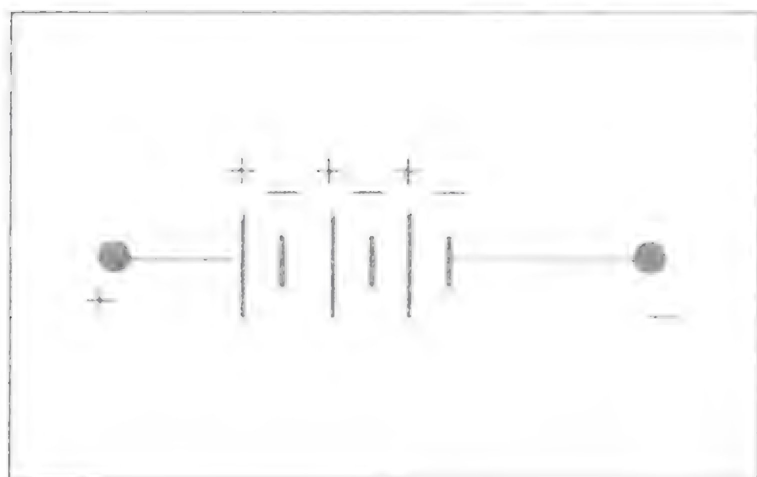
ܘܡܫܬܢܝܬܐ ܗܠܝܢ ܡܫܬܟܚܬܐ ܕܚܘܝܢܐ ܡܕܒܠܢܐ ܘܟܠܗܘܢ ܐܡܝܢܘܬܐ ܡܫܬܢܝܬܐ ܥܡܡܬܐ ܕܡܫܘܚܬܐ ܕܒܘܠܛܡܝܬܪ ܒܐܡܝܢܘܬܐ ܗܕܡܬܐ ܥܡ ܟ = ܠ ܥܘ

$$ܥܘܠ = \frac{ܣ . ܘ . ܩ \quad ܠ ܥܘ}{ܠ}$$

(٧ ـ ١٨) ܐܘܪܚܬܐ ܕܐܣܪܬܐ ܕܥ̈ܢܬܐ

ܦܬ̈ܐ ܡܕܝܢܬܐ ܒܢܘܥܬܐ ܕܥ̈ܢܬܐ ܐܣܝܪܐ ܟܠܗܝ (Battery) ܘܦܬܟܝ ܐܣܝܪܐ ܥ̈ܢܬܐ ܒܝ ܒܢܝܫܘܬܐ ܐܘ ܒܐܚܕܘܬܐ ܐܘ ܐܣܪܬܐ ܣܒܝܟܬܐ ܒܢܝܫܘܬܐ ܘܡܚܕܘܬܐ ܘܡܬܕܡܝܢ ܠܗ ܕܐܝܟ ܕܐܡܪ. ܥܠ ܐܣܪܬܐ ܕܥ̈ܢܬܐ ܕܗܢܝܢ ܟܠܗܘܢ.

١ ـ ܐܣܪܬܐ ܕܥ̈ܢܬܐ ܒܢܝܫܘܬܐ :



ܐܣܟܡܐ (٧ ـ ٢٠)

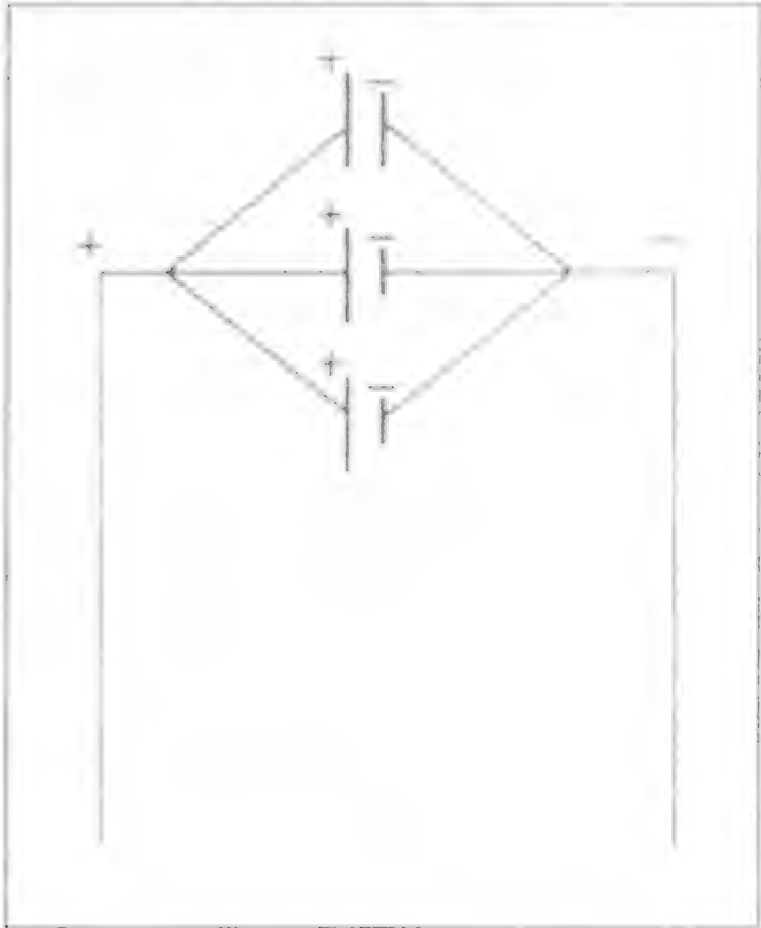
ܒܗܕܐ ܥܠܡܐ ܒܕܪܟܬܗ ܡܫܬܟܚܬܐ ܐܣܪܬܐ ܕܥ̈ܢܬܐ ܒܢܝܫܘܬܐ ܒܕ ܦܬܝ ܐܣܝܪܐ ܡܘܫܚܬܐ ܩܘܡܐ ܡܢ ܒܚܘܪܐ ܠܡܘܫܚܬܐ ܓܠܘܝܐ ܕܚܘܪܐ ܢܝܫܐ ܘܐܘܕܝܐ ܐܣܟܡܐ (٧ ـ ٢٠) ܘܥܠܗ ܗܘܐ ܡܘܫܚܬܐ ܡܕܡܝܐ ܕܟܠܗܝ ܩܘܡܐ ܘܡܘܫܚܬܐ ܐܚܪܢܐ ܓܠܘܝܐ.

ܕܝܠܢܝܬܐ ܕܐܣܪܬܐ ܕܢܝܫܘܬܐ :

١ ـ ܣ . ܘ . ܩ ܕܟܠܗܝ ـ ܒܘܢ̈ܐ ܣ . ܘ . ܩ ܕܥ̈ܢܬܐ

٢ . ܚܝܠ ܕܟܗܪܒܐ = ܡܢܝܢܐ ܕܥܝܢܬܐ × ܚ . ܙ . ܟ ܕܚܕ ܥܝܢܐ.

٣ . ܐ. ܦܫܛܠܘ ܐܫܝܕܐ ܐܘ ܟܗܪܒܐ ܠܐ ܒܗ ܠܦܘ ܕܟܗܪܒܐ ܡܫܝܚܬܐ ܝܠܗ ܣܟܪܬܗ ܡܢ ܩܘܡ. ܕܒܘܪܬܐ ܕܟܝܪܬܐ ܘܗܘ ܟܘܐ ܠܦܘ ܚܒܪܢܐ ܒܟܠ ܥܝܢܐ ܡܢ ܥܝܢܬܐ ܕܟܗܪܒܐ. ܘܐܝ ܟܘܪܢܐ ܚܕܢܐ ܝܗܘܐ ܗܘܝܬܐ ܒܐܝܕ ܠܦܘ ܒܐܝܕܬܐ ܚ . ܙ . ܟ ܕܟܗܪܒܐ. ܗܢܐ ܘܕܝܢ ܒܐܝܕܬܐ ܕܡܢܝܢܐ ܕܥܝܢܬܐ ܐܫܝܕܬܐ ܒܢܩܦܘܬܐ ܘܒܗܘܐ ܐܘ ܠܦܘ ܚܒܪܢܐ ܒܟܠ ܥܝܢܐ.



ܐܣܟܝܡܐ (٧ - ٢٠ ܒ)

٢ . ܐܫܕܬܐ ܕܥܝܢܬܐ ܒܫܒܘܩܬܐ :

ܒܕܪܬܐ ܚܠܘܦ ܒܕܪܫܬܘܦ ܡܫܚܬܐ ܕܐܫܕܬܐ ܕܥܝܢܬܐ ܒܫܒܘܩܬܐ ܗܘܝܐ ܒܐܫܕܬܐ ܕܡܘܨܠܗ ܦܘܡܐ ܒܚܕ ܐܬܪܐ ܘܡܘܨܠܗ ܦܠܓܐ ܒܚܕ ܐܬܪܐ ܐܚܪܢܐ (٧ - ٢٠ ܒ). ܘܡܨܦܐ ܐܬܪܐ ܡܕܡܝܐ ܡܘܨܠܐ ܦܘܡܐ ܕܟܗܪܒܐ ܘܐܚܪܢܐ ܡܘܨܠܐ ܦܠܓܐ ܕܟܗܪܒܐ. ܘܐܝܟܢܐ ܡܘܚܒܪܢܐ ܡܢ ܕܐܗܐ ܐܫܕܬܐ ܝܠܗ ܠܡܢܬܐ ܟܠ ܠܦܘ ܠܐܝܕܐ ܠܚܒܪܢܐ ܐܝܟ ܕܗܝܡ ܚܒܪܢܐ ܠܠܦܘ ܚܒܘܪܐ ܚܕܐ.

ܕܝܠܢܝܬܐ ܕܐܫܕܬܐ ܕܫܒܘܩܬܐ :

١ . ܚܝܠܐ ܙܝܘܥܐ ܕܗܘܕܢܐ ܕܟܗܪܒܐ = ܚܝܠܐ ܙܝܘܥܐ ܕܗܘܕܢܐ ܕܚܕ ܥܝܢܐ.

ܚ . ܙ . ܟ ܕܟܗܪܒܐ = ܚ . ܙ . ܟ ܕܚܕ ܥܝܢܐ

٢ . ܡܠܝܬܐ ܕܟܘܪܢܐ ܠܡܫܠܡܢܐ ܠܦܘ ܕܟܗܪܒܐ = ܟܘܢܫܐ ܕܡܠܝܬܐ ܕܟܘܪܢܐ ܠܦܘ ܕܥܝܢܬܐ ܘܗܝܘ ܒܦܠܛ :

$$\text{ܚܝܠ ܟܗܪܒܐ} = \frac{\text{ܚܝܠ ܕܚܕ ܥܝܢܐ}}{\text{ܡܢܝܢܐ ܕܥܝܢܐ ܡܩܘܝܢܐ}}$$

٣ . ܠܦܘ ܕܟܗܪܒܐ ܚܒܪܢܐ ܒܟܘܪܢܐ ܒܪܐ ܡܫܝܚܬܐ ܝܠܗ ܣܟܪܬܗ ܡܢ ܩܘܡ. ܕܒܘܪܬܐ ܒܡܘܪܒܝܬܐ ܕܟܝܪܬܐ ܕܟܘܪܢܐ ܕܠܦܘ ܐܢܫܐ ܡܢ ܥܝܢܬܐ ܒܟܘܢܫܬܐ ܘܗܝܘ ܒܦܠܛ :

ܠ ܟܠܗܝ = ܠ ܚܕܐ / ܡܢܝܢܐ ܕܒܢܝܐ ܡܫܘܢܝܐ

٣ ـ ܐܣܪܬܐ ܣܒܝܛܬܐ

ܟܕ ܐܣܪܐ ܡܢܝܢܐ ܡܢ ܡܫܚܐ ܡܢ ܒܢܝܐ ܕܡܢܝܢܐ ܒܢܝܫܘܬܐ ܒܚܕ ܡܕܪܐ ܝܢ ܟܢܐ ܐܣܪܬܐ ܒܢܘܪܬܐ ܡܢ ܕܐܢܐ ܡܕܪܐ ܒܡܫܘܬܐ ܠܡܢܬܐ ܥܠ ܟܠܗܝ ܒܢܝܐ ܐܣܪܐ ܐܣܪܬܐ ܣܒܝܛܬܐ ܐܝܟ ܒܐܣܟܡܐ (٧ ـ ٢٠ ܠ) ܘܦܪܝܫܐ ܡܘܦܪܫܬܐ ܐܣܪܬܐ ܣܒܝܛܬܐ ܠܦܘܬ ܒܕܝܠܐ ܕܢܝܫܘܬܐ ܘܡܫܘܚܬܐ ܕܒܢܝܐ ܘܡܘܬܪܐ ܡܘܬܪܢܐ ܕܐܗܐ ܐܣܪܬܐ ܗܠܘ ܡܢܬܐ ܥܠ ܚ.ܡ.ܥ ܕܟܢܐ ܘܠܦܐ ܒܕ ܚܠܢܐ ܠܦܘܬ ܡܫܘܚܬܐ ܕܒܘܪܬܐ ܒܘܪܟܬܐ.

ܐܣܟܡܐ ٧ ـ ٢٠ ܠ

ܛܘܦܣܐ

ܟܠܗܘ ܐܣܪܐ ܐܪܒܥ ܒܢܝܐ ܐܣܪܬܐ ܣܒܝܛܬܐ ܒܟܠܗܝ ܡܕܪܐ ܫܒܥ ܥܠܝܗ ܡܕܪܐ ܗܠܬܐ ܒܢܝܐ ܐܣܪܐ ܒܢܝܫܘܬܐ ܘ ܚ.ܡ.ܥ ܕܟܢܐ ܝܘܬܐ ٢ ܒܘܠܛ ܘܡܘܬܪ ٠٫٢ ܐܘܡ ܘܟܠܗܘ ܐܣܪܐ ܟܠܗܝ ܠܛܒܥܐ ٧٫٥ ܐܘܡ. ܐܢܫ ܠܦܐ ܕܟܢܐ ܚܒܪܢܐ ܒܛܒܥܐ ܘܠܦܐ ܚܒܪܢܐ ܒܟܠ ܒܢܐ ٧ ـ ٢١

ܐܣܟܡܐ ٧ ـ ٢١

ܒܪܢܐ

ܡܢ ܒܕܝܠܐ ܕܢܝܫܘܬܐ

ܚ.ܡ.ܥ ܕܟܠܗܝ = ٣ × ܚ.ܡ.ܥ ܕܚܕܐ

= ٣ × ٣

= ٦ ܒܘܠܛ

ܘܡܢ ܒܕܝܠܐ ܕܡܫܘܚܬܐ

ܚ.ܡ.ܥ = ܚ.ܡ.ܥ ܕܡܕܪܐ

= ٦ ܒܘܠܛ

ܘܡܢ ܒܕܝܠܐ ܕܢܝܫܘܬܐ

ܚܘܠ ܕܡܫܪܐ = ٣ × ܚܘܠ ܕܥܢܢܐ

= ٣ × ٠،٢ ܐܘܡ

ܘܡܢ ܒܕܟܐ ܕܡܫܘܚܬܐ

$$ܚܘܠ = \frac{ܚܘܠ\ ܕܡܫܪܐ}{٢}$$

$$ܚܘܠ\ ܕܦܠܓܘ = \frac{٣ \times ٠،٢}{٢} = ٠،٣\ ܐܘܡ$$

$$ܠ\ ܕܦܠܓܘ = \frac{ܫ\ ،\ ܦ\ ܕܦܠܓܘ}{ܚܘܒ + ܚܘܠ\ ܕܦܠܓܘ} = \frac{٦}{٥،٧ + ٠،٣} = \frac{٦}{٦} = ١\ ܐܡܦܝܪ$$

$$ܠܦܐ\ ܕܚܕ\ ܥܢܐ = \frac{ܠܦܐ\ ܕܥܢܐ}{ܡܢܝܢܐ\ ܕܡܫܪܐ\ ܕܥܢܐ}$$

$$= \frac{١}{٢}$$

(٧ ـ ١٩) ܢܡܘܣܐ ܕܟܝܪܟܗܘܦ Kirchhoff's Law

ܢܡܘܣܐ ܩܕܡܝܐ : ܢܡܘܣ ܢܩܕܬܐ ܕܚܘܝܬܐ

ܚܘܒܢܐ ܕܠܦܐ ܚܫܘܒܐ ܕܥܠ ܢܘܩܙܬܐ

ܡܢ ܡܪܟܐ ܚܘܕܪܢܐ ܗܘܐ ܚܘܒܢܐ ܕܠܦܐ

ܦܠܛܝܐ ܡܢ ܗܝ ܢܘܩܙܬܐ. ܐܘ ܡܝܬܒܠ

ܠܦܐ ܚܫܘܒܐ ܕܢܘܩܙܬܐ ܫܘܫܡܬܐ ܠܦܐ

ܦܠܛܝܐ ܡܢܗ ܒܗܘܝ ܫܠܡܐ ܗܢܐ ܘܕܡܝ

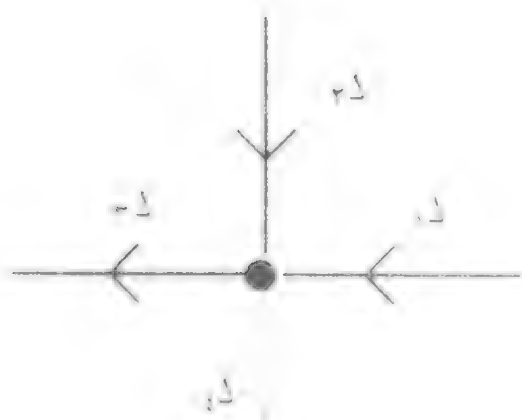
ܚܘܒܢܐ ܡܘܠܝܐ ܕܠܦܐ ܫܩܡܝܐ ܒܢܘܩܙܬܐ

ܡܢ ܡܪܟܐ ܚܘܕܪܢܐ ܗܘܐ ܫܩܝܠܐ ܐܝܟ

ܒܨܘܪܬܐ (٧ ـ ٢٢) ܟܕ ܗܘܐ

$ܠ_{١} + ܠ_{٢} - ܠ_{٣} - ܠ_{٤} = ٠$

ܢܡܘ. ܬܪܝܢܐ : ܢܡܘܣ ܢܩܕܬܐ ܕܬܘܩܦܐ



ܨܘܪܬܐ (٧ ـ ٢٢) ܢܘܩܙܬܐ ܕܦܠܘܓܬܐ ܕܠܦܐ ܒܕܘܪܬܐ ܚܘܕܪܢܝܬܐ

ܒܘܢ̈ܝܐ ܡܘܠ̈ܝܐ ܠܬܘܪ̈ܢܝܐ ܕܟܘܪ̈ܝܐ ܚܕܪ ܟܠ ܕܘܪܐ ܕܟܣܪܬܐ ܡܢ ܟܪܟܐ ܕܥܒ̈ܪܐ ܗܘܐ ܣܦܝܩܐ ܘܡܢܝܢ ܡܟܘܪܐ ܣ.ܘ.ܩ ܥܠ ܐܗܐ ܕ:

١ ـ ܐܝ ܦܝܕܠ ܝܢܐ ܡܢ ܡܘܠܟܐ ܠܠܘܪܐ ܠܡܘܠܟܐ ܫܘܡܐ ܐܝܟ ܐܡܐ ܘܢܕܐ ܟܠܘܪ̈ܝܐ (+ܣ.ܘ.ܩ) ܟܘܢ ܝܢܐ ܠܒܕܐ ܟܘܠܠܐ ܫܘܡܐ ܥܠ ܠܟܠܝܢܐ ܕܟܣܘܢܬܐ. ܟܫܘܠܠܐ ܐܣܪܝܢܐ ܡܡܐ ܟܘܝܠܬܢܗ ܡܢ ܟܘܡܘܬܐ ܕܟܘܪ̈ܝܐ ܟܘܦܐ ܠܟܘܡܘܬܐ ܐܣܪܢܬܐ ܡܢ ܟܘܪ̈ܝܐ ܠܠܢܐ.

ܘܦܝܢ ܡܕܢܐ ܐܗܐ ܙܘܟܐ ܟܙܘܟܐ ܣ.ܘ.ܩ ܘܐܝ ܦܝܕܐܝ ܢܘܗܐ ܟܘܦܟܐ ܕܐܗܐ ܙܘܟܐ ܟܘܗܐ (− ܣ.ܘ.ܩ) ܐܝܟ ܟܐܨܘܪܬܐ (٧ ـ ٢٣).

ܐܨܘܪܬܐ (٧ ـ ٢٣)

ܦܘܫܩܐ

ܐܝܟܢ ܟܘܠܠܐ ܕܠܦܐ ܦܟܘܢܐ ܟܕܘܪܐ ܠܠܐܬܐ ܟܐܨܘܪܬܐ

ܫܪ̈ܝܐ

ܠܦܘ ܢܡܘܣܐ ܕܦܟܘܢܬܐ ܕ ܟܘܗܘ

ܠ = ܣܦܝܩܐ

$ܠ_{١} + ܠ_{٢} - ܠ_{٣} =$ ܣܦܝܩܐ ... (١)

ܠܦܘ ܕܘܪܐ ܕܟܝܪܬܐ ܐ ܒ ܓ ܕ ܐ

$- ٤٠ + ١ ܠ_{١} + ٣ ܠ_{١} \quad ٧ ܠ_{٢} \quad ٢ ܠ_{٢} + ١٥ =$ ܣܦܝܩܐ

٤ ܠ$_{١}$ − ٩ ܠ$_{٢}$ = ٢٥ ... (٢)

ܒܕܘܪܬܐ ܕܒܝܢܬܐ ܐ ܕ ܗ ܘ ܐ

− ١٥ + ٢ ܠ$_{٢}$ + ٨ ܠ$_{٣}$ = ܣܦܝܪܐ

٩ ܠ$_{٢}$ + ٨ ܠ$_{٣}$ = ١٥ ... (٣)

ܘܒܫܪܝܬܐ ܕܫܘܝܘܬܐ ١ ، ٢ ، ٣ ܒܚܕܐ ܚܕ :

ܠ$_{١}$ = ٤ ܡܠܦ ، ܠ$_{٢}$ = −١ ܡܠܦ ، ܠ$_{٣}$ = ٣ ܡܠܦ

ܚܙܝܐ ܗܘܐ ܠ$_{٢}$ ܦܠܘܓܐ ܕܡܪܐ ܘܗܘܐ ܥܠ ܕܒܪܘܢ ܡܕܡܐ ܥܠ ܡܘܥܕܐ ܕܒܪܘܢܐ ܫܒܝܩܐ ܗܢܐ ܘܕܝܢ ܠ$_{٢}$ = ١ ܡܠܦ ܡܢ ܕ ܠܘܬ ܐ.

٢ ـ ܐ. ܠܘܒܠܘܬ ܙܘܥܐ ܕܡܢܝܢܬܐ ܡܢ ܠܘ ܒܘܪܐ ܒܙܘܥܐ ܕܠܦܐ ܒܘܠܒܠܐ ܒܘܣܠܦܐ ܠܘ ܒܘܡܢܐ ܥܠ ܦܠܘܓܐ (− ܠ ܡܘ) ܐܝܟ ܒܨܘܪܬܐ (٧ ـ ٢٤ ܐ) ܘܗܘܐ ܗܘܝܐ ܒܙܘܥܐ ܗܦܟܐ (+ ܠ ܡܘ) ܐܝܟ ܒܨܘܪܬܐ (٧ ـ ٢٤ ܒ) ܘܗܘܐ ܒܡܢܝܢܐ ܡܘܠܝܐ ܐܝܟ ܕܐܬܐ :

ܒܡܢܝܢܐ ܚ.ܘ.ܙ + ܒܡܢܝܢܐ ܠ ܡܘ = ܣܦܝܪܐ

ܘܒܨܘܪܬܐ (٧ ـ ٢٥) ܠܘ ܡܢܝܢܐ ܡܢ ܒܘܣܘܟܐ (ܒ) ܒܙܘܥܐ ܕܡܘܠܝܐ ܕܡܠܬܐ ܗܘܐ : ܚ.ܘ.ܙ − ܠ ܡܘܠ = ܣܦܝܪܐ.

ܨܘܪܬܐ (٧ ـ ٢٤ ܐ)

ܨܘܪܬܐ (٧ ـ ٢٤ ܒ)

ܨܘܪܬܐ (٧ ـ ٢٥)

(٧ - ٢٠) ܚܫܚܬܐ ܕܡܫܘܚܬܐ ܕܢܘܗܪܐ

ܒܙܒܢ ܟܡܫܚܫܚ ܕܡܫܘܚܬܐ ܝܠܗ ܡܫܘܚܐ ܘܦܪܫܐ ܕܥܘܒܠܐ ܚܫܝܒܐ ܘܦܬܚܐ ܟܡܫܡܫܬܐ ܟܘܛ (ܓܘܠ/ܪܦܦܐ) ܐܘ ܟܝܠܘܘܛ.

ܘܡܫܘܚܬܐ ܕܡܫܘܠܚܝܠܗ ܡܢܐ ܕܢܗܘܪܐ ܟܠܐ ܥܠ ܐܡܘܪܐ ܕܢܦܠܝ ܡܢܗ ܡܢܐ ܘܥܠ ܡܘܫܚܐ ܕܡܢܐ ܢܦܝܠܐ ܟܡܕ ܪܦܦܐ.

ܘܐܝܟ ܐܡܪܐ ܡܢ ܕܒܡܫܐ ܠܐܘ ܐܝܟ ܕܦܪܝܬܐ ܟܘܪܟܐ ܟܕ ܡܫܘܚܬܐ ܡܫܘܟܚܬܐ ܐܝܟ ܡܫܝܚܬܐ ܕܟܘܪܐ ܐܘ ܫܝܢܬܐ ܕܟܗܪܐ ܐܘ ܙܝܬܐ ܕܡܫܓܘܪ ܐܚܠܐ ܥܠ ܦܘܪܫܢܐ ܕܟܘܫܢܐ ܟܡ ܗܪܘܡ ܢܘܩܘܐ ܘܠܦܐ ܥܒܪܐ ܡܢ ܐܝܟ ܗܘܫܢܐ. ܘܐܝܟ ܟܝܪܐܠܘ ܥܠܝ ܟܝܟܒܪ ܥܘܒܠܐ ܚܫܝܒܐ ܟܘܝܠܬܐ ܕܟܫܘܝܬܐ ܟܡ ܗܪܝ ܢܘܩܘܐ ܝܠܗ:

ܥܘܒܠܐ = ܦ × ܟ

ܒܕ ܦ ܦܘܪܫܢܐ ܕܟܘܫܢܐ ܟܝܢܝܗܝ ܘܒܕ ܡܫܘܚܬܐ = $\frac{ܥܘܒܠܐ}{ܙܒܢܐ}$

ܡܫܘܚܬܐ = $\frac{ܦ \times ܟ}{ܙ}$ ܐܝܠܐ ܠ = $\frac{ܟ}{ܙ}$

ܡܫ = ܦ ܠ

= ܦܘܠܛ × ܐܡܦܝܪ = $\frac{ܓܘܠ}{ܟܠ} \times \frac{ܟܠ}{ܪܦ} = \frac{ܓܘܠ}{ܪܦ}$ = ܘܛ

<u>ܡܘܦܩܐ</u>

ܕܠܡܐ ܟܘܪܟܐ ܢܗܪܐ ܒܡܫܘܚܬܐ ١١٠ ܦܘܠܛ ܘܠܦܐ ܢܗܪܐ ܝܠܗ ٠٫٥ ܐܡܦܝܪ. ܟܡܐ ܝܠܗ ܡܫܘܚܬܗ؟

ܫܪܝܐ

ܡܫ = ܦ ܠ

= ١١٠ ܦܘܠܛ × ٠٫٥ ܐܡܦܝܪ = ٥٥ ܘܛ

ܐܢ ܡܫܚܠܦ ܟܘܪܐ ܕܠܟܫܐ ܟܘ

ܡܫ = ܦ ܠ = (ܠ ܟܘ) × ܠ

ܦ٢
ܡܫ = ܠ٢ ܟܘ = ———
ܟܘ

ܘܡܕܝܟܬܐ ܗܠܗ ܕܡܫܚܬܐ ܟܠܢܝܬܐ ܡܘܬܒܬܐ ܒܕܘܟܬܐ = ܡܫܚܬܐ ܡܘܬܒܬܐ ܒܚܒܠܢܐ + ܡܫܚܬܐ ܡܘܬܒܬܐ ܓܘ ܡܚܘܝܢܐ.

ܘܐܝ ܟܘܪܐ ܕܚܒܠܢܐ = ܟܘܒ

ܡܫܚܬܐ ܟܠܢܝܬܐ ܡܘܬܒܬܐ = ܠ٢ ܟܘܒ + ܠ٢ ܟܘܟ

ܐܘ ܡܫܚܬܐ ܟܠܢܝܬܐ = ܠ (ܟܘܒ + ܟܘܟ) × ܠ

= ܣ . ܙ . ܩ × ܠ

ܐܦ ܡܫܚܬܐ ܗܠܗ ܡܬܟܬܒܐ ܐܝܟ ܕܐܬܐ:

(ܣ . ܙ . ܩ)٢
ܡܫܚܬܐ ܟܠܢܝܬܐ = ———————
ܟܘܒ + ܟܘܟ

ܘܠܣܬܒܢܐ ܕܡܫܚܬܐ ܕܡܘܕܥܬܐ ܐܝܢܫܬܐ ܠܫܢܝܬܐ ܕܟܡܐ ܘܐܢܐ ܕܕܒܪܫ ܕܡܠܦܚܘܬܐ ܐܝܢܫܬܐ ܠܫܢܝܬܐ ܗܠܘ ܕܒ ܡܢ ܣ ܙ ܩ ܕܡܚܘܝܬܐ ܒܚܘܠܐ ܕܚܘܒܐ ܦܠܡܐ ܓܘ ܡܚܘܝܬܐ ܘܐ. ܒܡܠܦܚܘܬܐ ܕܫܢܝܬܐ ܟܠ ܗܘܦܐ ܕܟܡܐ ܗܘܐ ܦ ܘܠܦܐ ܕܫܢܝܬܐ ܠ ܒܗܘܐ:

ܦ = ܣ.ܙ.ܩ + ܠ ܟܘܟ

ܘܒܕ ܡܫܚܬܐ ܡܘܡܕܒܬܐ ܠܫܢܝܬܐ ܗܠܗ ܦ ܠ

ܦܕܘܗܝ ܗܒܐ ܒܗܘܦܐ ܗܡܠܢܐ ܡܢ ܗܘܡܠܬܐ ܗܘܟܠܗܝ ܗܠܗ:

ܦ = ܣ . ܙ . ܩ + ܠ ܟܘܟ

ܘܒܕ ܡܫܚܬܐ ܡܘܡܕܒܬܐ ܠܫܢܝܬܐ ܗܠܗ ܦ ܠܦ ܠ = ܣ . ܙ . ܩ ܠ + ܠ٢ ܟܘܟ

ܦܕܘܗܝ ܗܒܐ ܒܗܘܦܐ ܗܡܠܢܐ ܡܢ ܗܘܡܠܬܐ ܗܘܟܠܗ ܗܠܗ:

١ . ܦܠܓܐ ܕܒܗܘܦܐ ܣ . ܙ . ܩ ܗܠܗ ܡܫܚܬܐ ܙܒܢܐ ܕܒܗܘܦܐ ܒܡܕܒܪܐ ܡܣܘܚܠܦܐ ܠܗܘܦܐ ܒܫܢܝܬܐ ܙܡܢܐ ܘܗܠܗ ܗܘܦܐ ܡܘܬܪܢܐ.

٢ . ܐܠܐ ܠ٢ ܟܘܟ ܗܠܗ ܡܫܚܬܐ ܙܒܢܐ ܕܒܗܘܦܐ ܦܠܡܐ ܒܐܫܟܡܬܐ ܕܫܡܫܘܬܐ ܓܘ ܟܡܐ.

ܐܦ ܡܫܘܚܬܐ ܕܝܠܗ ܚܘܫܒܢܬܐ ܕܡܫܘܚܬܐ ܡܬܡܪܟܫܢܝܬܐ ܡܢ ܓܒܝ ܡܪܟܫܬܐ ܒܐܚܝܕܘܬܐ ܕܡܫܡܫܬܐ ܠܬܘܪܬܐ ܒܪܬܐ. ܘܐ. ܦܘܪܫܢܐ ܕܡܪܟܫܢܐ ܓܠ ܡܘܦܩܐ ܕܡܪܟܫܬܐ ܗܘܐ ܦ ܘܠܦܐ ܕܒܘܪܬܐ ܠ ܒܗܘܐ :

ܦ = ܡ.ܓ.ܚ − ܠ ܥܘܠ

ܘܡܫܘܚܬܐ ܡܬܡܪܟܫܬܐ ܡܢ ܓܒܝ ܡܪܟܫܬܐ ܦ ܠ = ܡ.ܓ.ܚ ܠ − ܠ^{2} ܥܘܠ

ܒܪܐ ܐܚܝܕܘܬܐ ܡ.ܓ.ܚ ܠ ܦܘܫ ܡܫܬܐ ܘܒܢܐ ܕܗܘܦܟܐ ܒܡܫܢܐ ܡܬܚܠܦܐ ܠܗܘܦܟܐ ܟܗܪܒܝܐ. ܐܠܐ ܠ^{2} ܥܘܠ ܦܘܫ ܡܫܬܐ ܘܒܢܐ ܕܗܘܦܟܐ ܡܬܚܠܦܐ ܠܫܚܡܘܬܐ ܓܘ ܒܪܒܝ ܘܦܘܪܫܢܐ ܒܢܬܗ̇ ܝܠܗ ܗܘܦܟܐ ܡܬܡܪܟܢܐ ܠܬܘܪܬܐ ܒܪܬܐ ܒܚܕ ܪܦܦܐ.

ܥܠ ܡܪܟܫܬܐ ܘܠܐ ܕܒܝܬ ܥܘܪܢܐ ܓܘܐ ܘܘܠܐ ܒܡܠܬܗ ܒܡܫܒܚܢܐ ܐܝܟ ܦܬܐ ܚܘܫܒܢܬܐ ܡܫܘܚܬܐ ܡܬܡܪܟܢܝܬܐ ܗܘ ܓܠܐ ܕܡܫܘܚܬܐ ܡܫܝܚܬܐ ܝܠܗ ܡܢܬܐ ܓܠܗ ܡܢ ܡܪܟܫܬܐ ܡ.ܓ.ܚ ܝܠܗ ܐܝܟ ܕܗܘܐ ܥܘܪܢܐ ܓܘܐ ܕܡܪܟܫܬܐ ܒܗܘܐ ܥܘܪܢܐ ܒܪܬܐ (ܥܘ = ܥܘܠ)

(٧ - ٢١) ܚܘܫܒܢܬܐ ܕܗܘܦܟܐ ܕܠܦܐ ܘܦܘܫܟܐ ܕܗܘܦܟܐ ܟܗܪܒܝܐ

ܗܘܦܟܐ ܟܗܪܒܝܐ ܝܠܗ ܡܫܘܚܬܐ ܥܘܦܦܬܐ ܒܙܒܢܐ

ܗܘܦܟܐ ܐܘ ܚܘܠܠܐ = ܡܢ × ܙ

ܚܘܠܠܐ ܒ ܦ ܠ × ܙ ...... (٧ — ١٥)

ܐܢ ܓܒܢܐ ܗܘܐ ܥܘܪܢܐ ܒܗܘܐ

ܗܘܦܟܐ ܟܗܪܒܝܐ = ܠ^{2} ܥܘ ܙ .... (٧ — ١٦)

ܗܘܦܟܐ ܟܗܪܒܝܐ = $\frac{ܦ^{2}}{ܥܘ}$ × ܙ .... (٧ — ١٧)

ܘܦܝܫ ܒܠܐ ܗܘܦܟܐ ܟܗܪܒܝܐ ܐܝܟ ܐܪܒܥܐ ܐܚܪܢܐ ܕܗܘܦܟܐ ܒܓܘܠ ܐܠܐ ܠܒܝܬܐ ܡܬܚܫܒܝܐ ܦܬܐ ܡܬܦܠܓܬܐ ܚܕܐ ܟܗܪܒܝܬܐ ܦܬܐ ܡܕܝܢܬܐ (ܟܝܠܘܘܛ. ܫܥܬܐ)

ܒܕ ܥܠ ١ ܟܝܠܘܘܛ. ܫܥܬܐ = ١٠٠٠ ܘܛ × ٣٦٠٠ ܪ̈ܦܦܐ

= ٣٦٠٠٠٠٠ ܘܛ. ܪ̈ܦܦܐ

١ ܟܝܠܘܘܛ. ܫܥܬܐ = ٣،٦ ܡܝܓܐ ܓܘܠ

ܘܐܝܟ ܚܕܝܘܬܐ ܐܚܪܝܬܐ ܦܪܝܫܬܐ ܕܡܦܠܚܬܐ ܒܗ ܦܝܙܝܩܝ ܝܕܥܬܐ ܝܠܗ ܐܠܩܛܪܘܢ ܒܘܠܛ (١). ܘܝܠܗ ܟܡܘܬܐ ܕܚܝܠܐ ܐܠܩܛܪܘܢ ܓܘ ܙܘܥܐ ܒܝܢ ܬܪܝܢ ܢܘܩܙܐ ܒܗ ܦܘܫܢܐ ܦܘܪܫܢܐ ܕܚܝܠܐ ܟܗܪܒܝܐ ܚܕ ܒܘܠܛ.

ܐܠܩܛܪܘܢ ܒܘܠܛ = ܩ × ܦ

$١،٦ \times ١٠^{-١٩}$ ܟܘܠܘܡ × ١ ܒܘܠܛ

$= ١،٦ \times ١٠^{-١٩}$ ܟܘܠܘܡ × $\frac{\text{ܓܘܠ}}{\text{ܟܘܠܘܡ}}$

ܐܠܩܛܪܘܢ ܒܘܠܛ = $١،٦ \times ١٠^{-١٩}$ ܓܘܠ

ܘܦܝܫ ܡܘܟܪܟܢܐ ܛܝܡܐ ܕܚܘܫܒܐ ܡܘܬܪܢܝܬܐ ܒܒܘܝܬܐ ܕܡܫܡܫܝܢ ܕܟܝܠܘܘܐܛ. ܫܥܬܐ ܡܘܬܪܢܝܬܐ ܟܛܝܡܐ ܕܟܝܠܘܘܐܛ . ܫܥܬܐ.

ܛܘܦܣܐ

ܕܠܡܐ ܡܫܚܢܘ ٢٠٠ ܘܐܛ ܦܠܚ ܟܡܝܘܬܐ ٨ $\frac{\text{ܫܥܬܐ}}{\text{ܝܘܡܐ}}$. ܡܐ ܝܠܗ ܢܦܩܬܐ ܕܚܘܫܒܐ ܠܡܕܝܢܐ ٣٠ ܝܘܡܐ، ܛܝܡܐ ܕܚܕܝܘܬܐ ܕܟܗܪܒܐ ١٠ ܦܠܣܐ

ܫܪܝܐ

ܡܫ = ٢٠٠ ܘܐܛ = $\frac{٢٠٠}{١٠٠٠}$ ܟܝܠܘܘܐܛ = ٠،٢ ܟܝܠܘܘܐܛ

ܙܒܢܐ = ٨ $\frac{\text{ܫܥܬܐ}}{\text{ܝܘܡܐ}}$ × ٣٠ ܝܘܡܐ = ٢٤٠ ܫܥܬܐ

ܚܘܫܒܐ ܕܚܝܠܐ ܡܘܬܪܢܝܬܐ = ٠،٢ ܟܝܠܘܘܐܛ × ٢٤٠ ܫܥܬܐ
= ٤٨ ܟܝܠܘܘܐܛ . ܫܥܬܐ

ܛܝܡܐ = ٤٨ ܟܝܠܘܘܐܛ . ܫܥܬܐ × $\frac{\text{١٠ ܦܠܣܐ}}{\text{ܟܝܠܘܘܐܛ . ܫܥܬܐ}}$ = ٤٨٠ ܦܠܣܐ

ܛܘܦܣܐ

ܡܫܝܢܬܐ ܕܡܘܕܪ̈ܢܐ ܦܠܚ ܒܡܘܕܪ̈ܢܐ ܕܡܘܒܪ̈ܐ ٢١٠ ܒܫܠܛ ܘܡܫܩܐ ܡܢ ܠܦܐ ٥ ܙܡܝܢ ܦܝܫܠܘ ܡܘܦܠܚܢܐ ܠܡܫܝܢܬܐ (٥ ܠܝܘܡܐ) ܡܢ ܫܥܐ ܡܢ ١٢ ܥܠܝܘܬܐ ܠ ٦٠ ܥܠܝܘܬܐ ܐܢܟܣ ܘܒܢܐ ܐܝܟܢܐ ܘܛܝܡܐ ܕܚܘܦܐ ܡܘܚܒܪܐ ܐ، ܛܝܡܐ ܕ — ܟܝܠܘܘܛ ܝܠܘ ١٠ ܦܠܣܐ ܟܡܝܬܐ ܕܠܝܗ ܛܝܡܐ ܒܚܘܦܐ (ܫܦܝܪܘܬܐ ١٠٠٪)

ܫܪܝܐ

ܟܡܝܘܬܐ ܕܡܝܐ = ٥٠٠٠ ܡܛ³ × ١ ܟܓ/ܡܛ³ = ٥٠٠٠ ܟܓ

ܡܫܝܚܘܬܐ ܡܢܗ ܚܝܠܐ ܕܡܘܪܐ ܕܡܫܝܢܬܐ = ܦ/ܠ = ٢١/٥ = ٤٫٢ ܐܘܡ

ܫܦܝܪܘܬܐ ١٠٠٪

ܚܡܝܡܘܬܐ ܡܩܘܒܠܬܐ ܡܢ ܠܦܐ ܕܡܫܝܢܬܐ = ܚܡܝܡܘܬܐ ܕܡܩܒܠܝܗ ܡܝܐ

ܠܪ × ܟܘ × ܙ = ܦ × ܫܦܝܪܘܬܐ ܐܝܟܢܝܬܐ ܕܚܡܝܡܘܬܐ × ܕ

٢٥ × ٤٢ × ܙ = ٥٠٠٠ ܟܓ × ٤٫٢ ܓܘܠ/ܟܓ . ܡ × (٦٠ − ١٢) ܡ

ܘܡܢܗ ܙ = ٩٦٠ ܪܦܦܐ

ܚܘܦܐ ܡܘܚܒܪܐ = ܠܪ ܟܘ ܙ

ܐܢܐ ܚܘܦܐ ܡܘܚܒܪܐ = ٢٥ × ٤٫٢ × ٩٦٠ ܓܘܠ

= (٢٥ × ٤٫٢ × ٩٦٠) / ٣٦٠٠٠٠٠ ܟܝܠܘܘܛ . ܫܥܬܐ

= ٠٫٠٢٨ ܟܝܠܘܘܛ . ܫܥܬܐ

ܘܛܝܡܐ ܗܘܝ = ٠٫٠٢٨ ܟܝܠܘܘܛ . ܫܥܬܐ × ١٠ ܦܠܣܐ/ܟܝܠܘܘܛ . ܫܥܬܐ

= ٢٫٨ ܦܠܣܐ

ܒܘܚܵܢܵܐ

ܫ١ : ܓܒܝܼ ܠܘܼܟ݂ܘܿܢ ܦܘܼܢܵܝܵܐ ܬܪܝܼܨܵܐ ܒܟܠ ܚܕ ܡܼܢ ܐܵܢܹܐ ܕܐܵܬܹܐ

١ . ܡܩܘܡܘܬܐ ܕܡܝܣܬܐ ܕܠܦܐ ܒܘܪܟܬܐ

ܐ . ܝܬܝܪܬܐ ܡܢ ܐܘܦܠܘܬܐ ܕܓܠܘܦܐ.

ܒ . ܒܨܝܪܐ ܡܢ ܐܘܦܠܘܬܐ ܕܓܠܘܦܐ.

ܓ . ܫܘܝܐ ܠܐܘܦܠܘܬܐ ܕܓܠܘܦܐ.

ܕ . ܟܠܗܘܢ ܡܫܬܚܠܦܬܐ ܠܒܝܪܐ.

٢ . ܡܢܘ ܐܘܡ ܫܡܝ ܕܠܟ :

ܐ . ܟܠܗܘܢ ܡܩܘܡܢܐ

ܒ . ܡܩܘܡܢܐ ܐܢܘܢܝܐ.

ܓ . ܡܩܘܡܢܐ ܢܦܩܐ ܐܡܝܢܐܝܬ.

ܕ . ܡܩܘܡܢܐ ܢܦܩܐ ܥܡܘܕ ܒܪܓܫܐ ܕܠܒܢܐ.

٣ . ܟܘܪܟܐ ܕܒܘܪܟܬܐ ܕܚܕ ܡܢ ܣܘܠܐ ܕܐܬܐ ܟܝܐ ܒܡܢܝܢܬܐ ܕܪܕܝܐ ܕܡܩܡܩܘܬܐ :

ܐ . ܡܩܘܡܢܐ ܒ . ܟܪܟܘܟ ܓ . ܡܐܡܪܐ ܕ . ܦܪܘܠܐ

٤ . ܚܕ ܡܢ ܐܢܐ ܕܐܬܐ ܠܐ ܗܘܝܐ ܐܝܟ ܚܕܘܬܐ ܕܡܩܘܡܘܬܐ ܕܒܘܪܟܬܐ

ܐ . ܒܘܠܛ . ܐܡܦܝܪ ܒ . ܐܘܡ ܓ . $\frac{\text{ܒܘܠܛ}}{\text{ܐܡ}}$ ܕ . ܒܘܠܛ $\frac{\text{ܒܘܠܛ}}{\text{ܐܡ}}$

٥ . ܡܩܘܡܢܐ ܠܗ ܩܕܡܐ ܕܠ ܕܒ ܡܩܘܡܢܐ ܒܪܬܐ ܡܢ ܡܫܘܚܬܐ ܐܡܝܢܐ ܟܘܪܟܐ ܟܘܪܟܐ ٠،٥ ܐܡܦ ܐܝܟܢ ܕܦܝܫ ܐܡܝܪܐ ܕܠܗ ܟܘܪܟܐ

ܐ) ١ ܐܡܦ ܒ) ٠،٥ ܐܡܦ ܓ) ٠،١ ܐܡܦ ܕ) ٥ ܐܡܦ

٦ . ܚܕܐ ܡܢ ܐܢܐ ܠܐ ܠܗ ܚܕܘܬܐ ܕܡܩܘܡܘܬܐ.

ܐ. ܓܘܠ   ܒ. ܡܢܠܘܦܐ . ܬܚܡܐ

ܓ. ܐܠܗܡܕܘ̈ܢ ܒܘܠܝܐ   ܕ. ܡܢܠܘܓܘܠ . ܬܚܡܐ

٧. ܡܢܠܘܦܐ . ܬܚܡܐ ܬܘܪܐ

ܐ) ٣،٦ ܡܠܝܘ̈ܢ ܓܘܠ   ܒ) ٣٦ ܡܠܝܘ̈ܢ ܓܘܠ

ܓ) ١ ܡܠܝܘ̈ܢ ܓܘܠ   ܕ) ١٠ ܡܠܝܘ̈ܢ ܓܘܠ

٨. ܐܢ ܡܚܕܪܬܐ ܕܡܣܘܪܬܐ ܕܡܕܒܪܢܘܬܐ ܡܬܚܠܦ ٢ ܡܠܘܦ ܡܢܘܢܐ ܕܡܕܒܪܢܐ

ܡܫܚܠܦ $\frac{١}{٢}$ ܕܦܦܐ ܠܦܐ ܡܚܕܪܐ ܬܘܪܐ :

ܐ) ١ ܐܡܦܝܪ   ܒ) ٢ ܐܡܦܝܪ   ܓ) ٤ ܐܡܦܝܪ   ܕ) $\frac{١}{٢}$ ܐܡܦܝܪ

٩. ܡܘܢܐ ܐܕܝܫܬܐ ܕܗܘܠܐ ܢܛܪ ܡܘܢܐ :

ܐ) ١ ܣܡ٣ ܡܢ ܗܘܠܐ   ܒ) $\frac{١}{٢}$ ܣܡ٣ ܡܢ ܗܘܠܐ

ܓ) ٢ ܣܡ٣ ܡܢ ܗܘܠܐ   ܕ) ٣ ܣܡ٣ ܡܢ ܗܘܠܐ

ܒܘܚܢܐ

ܒ١ : ܡܳܢܝܼܠܶܗ ܕܝܠܳܢܳܝܬܳܐ ܕܐܘܪܬܳܐ ܕܢܶܫܦܘܬܳܐ ܠܗ ܟܬܘܒܳܐ؟

ܒ٢ : ܕܐܝܟ ܡܩܘܝܡ ܚܠܬܐ ܒܢܘܢܬܳܐ ܕܟܬܘܒܐ ܒܝܢܐ ܒܐܘܪܚܳܐ ܕܒܗ ܠܫܡܥܬܐ

ܘܐܘܡܝܬܐ ܐܝ ܟܬܘܒܐ ܝܗܘܐ : ܐ . ܪܟܘܒܐ ܒ . ܠܒܘܒܐ

ܒ٣ : ܡܳܐ ܝܠܶܗ ܟܒܘܪܐ ܡܟܒܪܢܐ ܒܟܬܘܒܐ؟

ܒ٤ : ܕܐܝܟ ܡܩܝܡܬܐ ܝܠܗ ܚܠܬܐ ܕܟܬܘܒܐ ܠܦܢܐ ܕܒܬܪ ܕܪܫܬܐ؟

ܒ٥ ܐܡܠܠܘ ܡܫܠܡܬܐ ܕܘܝܬܗܘܢ. ܒܐܘܪܚܐ ܠܟܪܝܬܐ ܡܢ ܦܬܠܘ ܒܘܫܠܦܐ

ܠܠܒܝܘܡܝܬܐ ܒܘܦܐ ܕܒܬܪ ܘܒܬܪ ܒܟܘܦܐ ܕܠܠܒܝܘܡܝܬܐ ܠܠܗ ܡܐ ܟܕܐ

ܠܡܕܝܬܐ ܕܠܠܒܝܘܡܝܬܐ؟

ܒ٦ ܒܕܐ ܕܒܝܘܒܬܐ ܕܒܢܬܐ ܐܫܒܐ ܒܫܒܗܘܬܐ ܝܟܫܝ ܠܦܐ ܒܢܬܗ ܠܗ

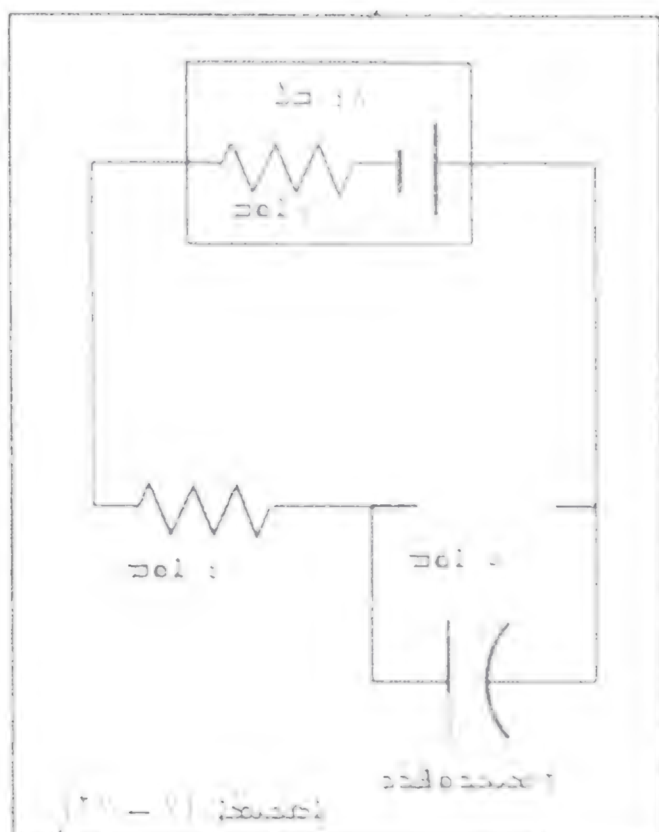
ܕܘܕܬܐ ܒܕܬܐ ܐ. ܦܬܠܝܗ ܐܫܒܐ ܒܢܫܦܘܬܐ ܐܝܟ ܕܗܘܐ ܟܬܘܒܐ ܒܕܫܐ ܠܗ

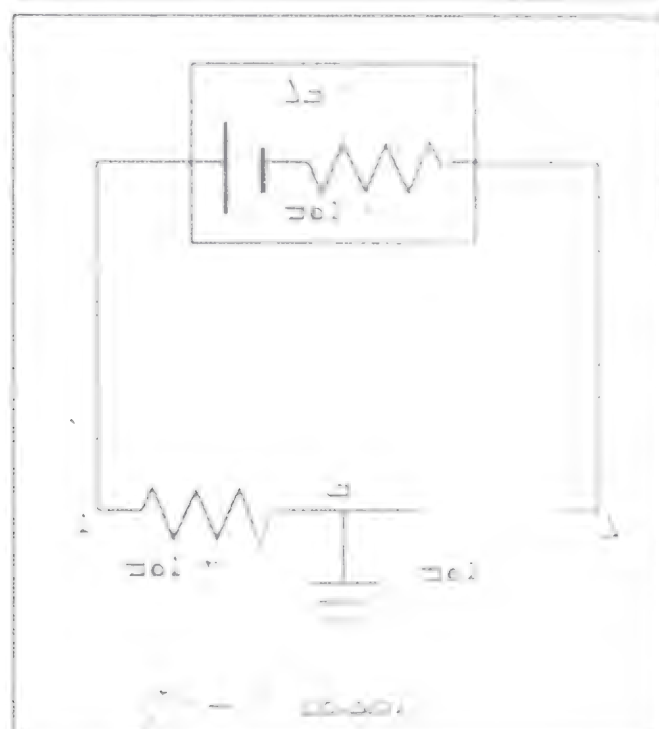
ܕܘܕܬܐ ܒܘܢܐ ܠܟܬܘܒܐ ܠܦܢܐ ܕܫܢܝ ܒܢܐ.

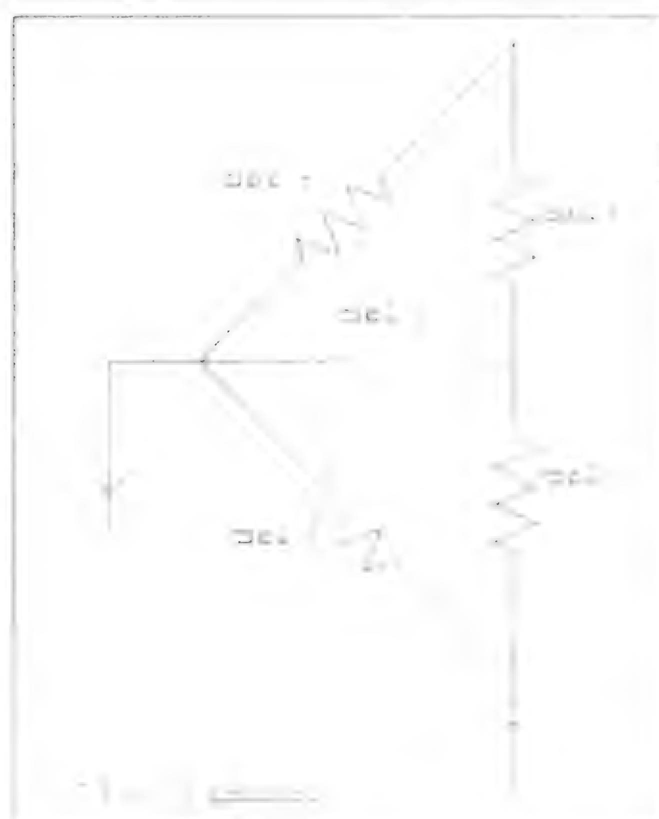
ܒ٧ : ܐܫܘܐ ܐܡܪ ܐܝܟܘܬܐ ܗܘܢܐ ܡܩܝܡܬܐ ܒܕܝܬܐ ܡܢ ܡܟܘܠܬܐ ܫ. ܪ. ܦ

ܒܒܘܢܘܗܝ ܝܠܗܬܐ؟

ܒ٨ ܐ. ܦܠܠܘ ܡܟܫܢܢܐ ܕܘܒܢܐ ܠܡܐ ܠܐ ܠܘܝܗ ܐܠܠܐ ܕܐܫܕܬܐ ܡܫܠܝܢܐ







1 ـ ܒܢܒܕܐ ܝܠܢܐ ܒܨܘܪܬܐ (٧ ـ ٢٧)

ܚܫܘܒ ܠܗ ܚܝܠܐ ܕܚܫܡܠܐ ܥܠ ܡܦܩܢܐ

ܕܡܦܩܢܘܬܗ ٢ ܡܝܟܪܘܦܪܕ.

ܦ : ٤٨ ܡܝܟܪܘܟܘܠܘܡ

٢ ـ ܒܢܒܕܐ ܝܠܢܐ ܒܨܘܪܬܐ (٧ ـ ٢٨)
ܢܦܫܘܬܐ ܕ ܦܬܠܐ ܡܘܡܝܬܐ ܕܢܕܒܢܐ
ܫܒܝܩ ܠܒܪܢܐ ܕܥܠ ܡܢ ܐ . ܒ ܘ ܐܢܫ
ܦ ܐ ܒ

ܦ : ܦ ܐ = + ٦ ܒܠ
ܦ ܒ = − ٢ ܒܠ
ܦ ܐܒ = ٨ ܒܠ
٣ ـ ܒܢܒܕܐ ܝܠܢܐ ܒܨܘܪܬܐ (٧ ـ ٢٩)
ܐܢܫ ܠܒܪܢܐ ܠܡܩܛܠܢܐ ܒܝܢ ܐ . ܒ
ܦ : ٤ ܐܘܡ
٤ ـ ܬܠܬ ܕܢܒܝܬܐ ܡܢܘܪܝܐ ܡܢ ܗܠܝܢ
ܬܢܝܐ ܠܒܪܢܐ ܒܘܢܐ ܕܥܠ ܬܢܐ ٠٫١٥ ܐܘܡ

ܘ ܚ.ܪ.ܡ ܕܥܠ ܬܢܐ ٢ ܒܘܠܛ. ܚܫܘܒ ܠܗ

ܚܝܠܐ ܕܠܒܪܢܐ ܕܐܠܐ ܐܬܪܗ ܒܢܦܩܘܬܐ

ܒܗ ܕܘܪܬܐ ܐܝ ܦܬܠܐ ܝܠܕܬܐ ܚܫܝܠܗ

ܡܢ ܡܚܘܝܢܐ ܒܠܛܢܘܬܗ ١٢ ܘܠܦܐ

ܕܚܫܝܠܐ ٤ ܐܘܡܝܢ.

٥ . ܒܢܝܢܐ ܓܠܝܐ ܒܐܨܘܪܬܐ (٧ . ٣٠)

ܐ. ܠܦܝ ܕܒܘܪܐ ܝܗܘܐ ١ ܡܠܝ ܐܡܦܝܪ ܒܡܬܐ

ܚܠܘ ܒܘܝܠܐ ܕܟܘܪܐ ܒܪܟܐ ܚܫܘܒܐ .

ܦ : ٩٩٤ ܐܘܡ

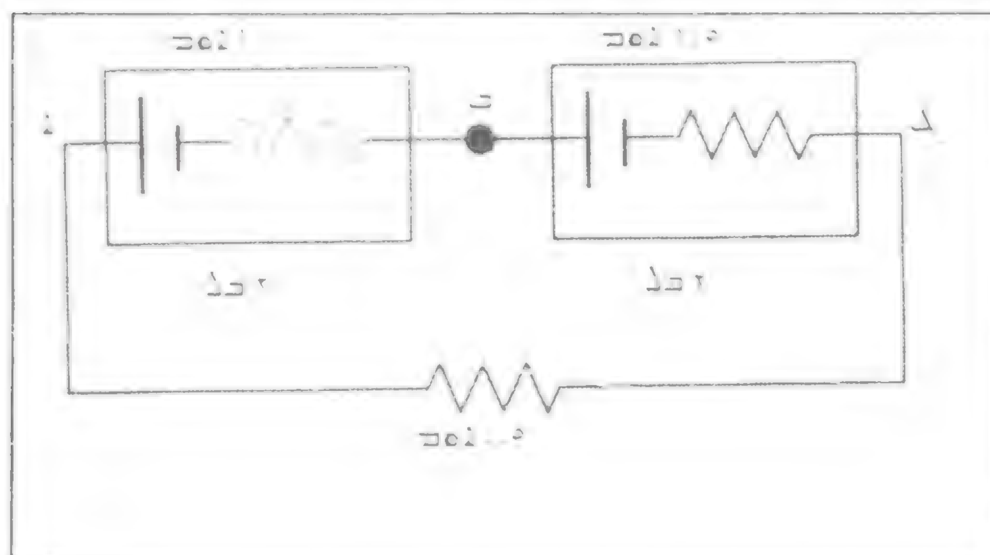
٦ . ܒܢܝܢܐ ܓܠܝܐ ܒܐܨܘܪܬܐ (٧ . ٣١)

ܐܚܝܕ ܦܘܪܫܢܐ ܕܟܘܫܢܐ ܒܝܢ ܫܘܦܐ ܕܟܠ

ܬܪܐ

$$\text{ܦ ܐܒ} = \frac{٢}{٣} \text{ ܒܘܠܛ}$$

(ܦ ܒ ܓ = ܣܦܪܐ)



ܐܨܘܪܬܐ (٧ . ٣١)

ܡܘܕܥܢܘܬܐ

ܚܙܝ ܗܘܝ ܕܦܘܪܫܢܐ ܕܟܘܫܢܐ ܦ ܒ ܓ = ܣܦܪܐ ܒܕ ܗܘܐ ܟܘܫܢܐ ܓܠܝܡܐ ܒܬܪܐ ܬܘܝܐ ܣ ، ܦ ܠܗ ، ܒܡ ܕܐܘܐ ܕܒܐ ܠܦܝ ܒܕܘܪܐ ܠܗܘܝܐ ܕܦܘܪܫܢܐ ܒܟܘܫܢܐ ܒܝܢ ܐ ، ܒ .

٧ . ܡܫܢܝܢܐ ܚ.ܘ.ܦ ٢٤ ܒܘܠܛ ܘܚܝܠܗ ٦ ܐܡܦ ܐܝܬ. ܦܬܝܠܘܗܝ ܡܣܡܟܬܐ ܡܣܡܟܐ ܒܟܘܪܐ ܟܡ١ ܦܪܬܝܐ ܕܟܡܝܬܐ ܬܠ ܗܘܦܐ ܚܘܐ ١٨ ܒܘܠܛ. ܘܐܝܬ ܦܬܝܠܗ ܡܣܡܟܐ ܡܣܡܟܐ ܒܟܘܪܐ ܟܡ٢ ܦܪܬܝܐ ܕܟܡܝܬܐ ܬܠ ܗܘܦܐ ܚܘܐ ١٢ ܒܘܠܛ. ܐܫܟܚ:

١ . ܟܡ١ . ܟܡ٢

٢ . ܦܫܘܩܐ ܒܝܢ ܚܫܒܘܢܐ ܠܓܝܓܐ ܠܘ ܡܢܝܢܐ ܕܦܪܬܝܐ $\frac{ܚܡ ١}{ܚܡ ٢}$

$$ܦ = ١٨ ܐܡܦ . ٦ ܐܡܦ . \frac{ܚܡ ١}{ܚܡ ٢} = \frac{٣}{٤}$$

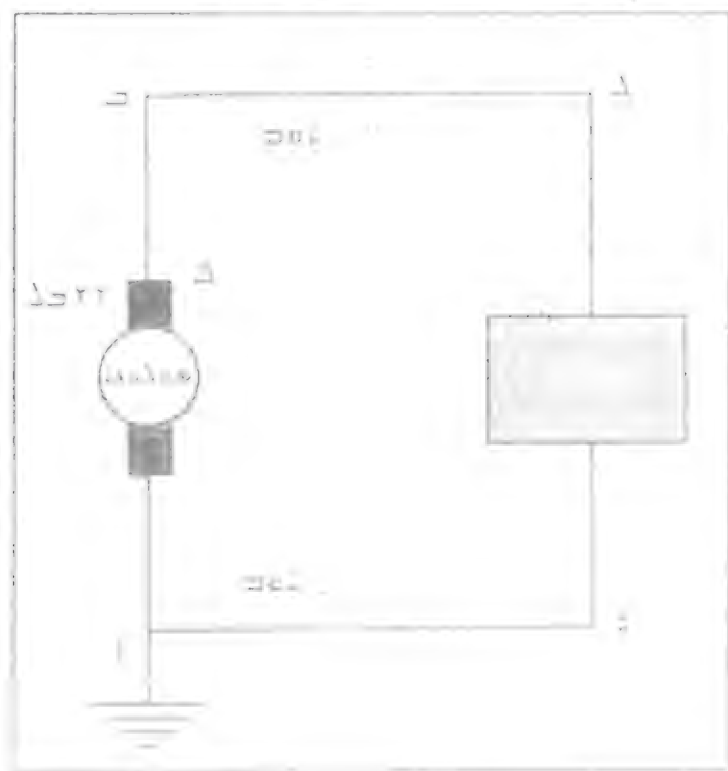
٨ . ܡܫܠܕܢܐ ܡܢ ܡܫܚܐ ܡܚܝܠܐ ܒܫܠܐ ٣٦ ܘܛ ܐܝ. ܦܬܝܠܘ ܐܡܝܕܐ ܠܟܘܪܐ ܒܕܪܐ ܒܫܠܘ ١ ܐܡܦ ܒܡܪܐ ܠܐ ܡܫܚܐ ܒܕܪܐ ܦܠܝܛܬܐ ܐܝ. ܦܬܝܠܘ ܐܡܝܕܐ ܡܚܘܠܐ ܒܢܝܘ ܠܟܘܪܐ ٥ ܐܡܦ.

ܦ : ٢٠ ܘܛ

٩ . ܕܠܡܐ ܒܘܪܬܐ (١٠٠ ܘܛ . ٢٠٠ ܒܘܠܛ) ܚܙܝܢ:

١ . ܟܘܪܐ ܕܕܠܡܐ . ٢ . ܠܦܘ . ٣ . ܚܫܒܫܘܬܐ ܕܡܫܠܕܠܘ ܒܡܨܚܐ ٧ ܡܛܝܐ ٤ . ܛܝܡܐ ܕܟܘܦܐ ܕܡܫܒܕܠܘ ܐ. ܦܠܝܠܘ ܒܡܫܚܐ ٦ ܒܟܠܐ ܒܝܘܡܐ ܘܛܝܡܐ ܕܚܕ ܒܠܘܘܛ ܚܘܐ ١٠ ܦܠܣܐ.

$$ܦ : ٠٠ ܐܡܦ \frac{١}{٢} ܐܡܝܕ ٢٠٠٠ : ٤٠ ܠܘܠ ١٨٠ ܦܠܣܐ$$



ܨܘܪܬܐ (٧ ـ ٣٢)

١٠ . ܒܨܘܪܬܐ (٧ ـ ٣٢) ܡܫܠܕܢܐ ܡܡܪܒ ܠܡܫܢܝܢܐ ܕܚܫܡܐ ܒܚܕ ܚܝܠܐ. ܦܪܬܝܐ ܕܟܡܝܬܐ ܬܠ ܗܘܦܐ ܕܡܫܠܕܢܐ ܚܘܐ ٢٣٠ ܒܘܠܛ ܘܠܦܐ ܕܚܝܠܐ ٥٠ ܐܡܝܕ ܘܟܘܪܐ ܕܟܠ ܡܢ ܦܪܬܝܐ ܐܬܠܐ ܒ ܓ . ܐܕ ܒܗܘܐ ٠،١ ܐܡܦ ܘܡܘܡܘܬܐ ܦܬܝܠܘ ܡܡܫܚܠܬܐ ܒܐܪܒܐ ܐܫܟܚ:

١ . ܟܡܝܬܐ ܕܡܘܡܘܬܐ ܒ

٢ . ܢܣܒܬܐ ܕܡܘܙܢܐ ܥܠ ܟܠ ܡܐܬܐ ܡܢ ܡܐܬܐ ܕܥܒܕܐ.

٣ . ܦܘܪܥܢܐ ܕܡܘܙܢܐ ܥܠ ܗܘܦܐ ܕܡܫܘܚܬܐ ܦ ܓ

٤ . ܡܫܘܚܬܐ ܡܨܠܝܢܝܬܐ ܠܡܫܘܚܬܐ.

ܦ : ٣٢٠ ܢܛ . ٥ ܢܛ . ٢٢٠ ܢܛ . ١١ ܣܢܛܘܡܛ

١١ . ܟܬܒ ܢܨܒܬܐ ܕܐܦܬܬܐ ܦܪܢܣܐ ܡܘܡܨܝܐ ܡܘܠܒܘ ܒܬܪ ܟܘܪܝܐ ܢܨܒܬܐ ١ , ٢ ܐܘܡ ܐ . ܦܘܪܥܢܐ ܕܡܘܙܢܐ ܥܠ ܗܘܦܐ ܕܟܘܪܝܐ ܬܪܝܢܐ ٢٠٤ ܒܘܠܛ ܐܝܟ ܡܥܢܐ ܕܥܒܕܐ ܕܟܬܒ ܒܫܬܒܬܐ ܚ ܪ ܦ ܠܟܠ ܥܢܐ ١٠٥ ܒܘܠܛ ܘܟܝܪܐ ܕܟܠ ܥܢܐ ٠،٥ ܐܘܡ.

ܦ : ٤ ܥܢܬܐ

١٢ . ܦܪܢܣܐ ܡܘܡܨܝܐ ܟܘܪܝܐ ܥܘܪܐ ܒܐܘܡܡܐ ܕܐܠܟܐ ܕܡܬܠܬܐ ܘܟܬܒ ܡܢܗ ܦܪܢܣܐ ܡܘܡܨܝܐ ܒܡܚܘܬܐ ٢٠ ܒܘܠܛ ܘܠܦܐ ܕܠܒܬܐ ܗܘܐ ٢ ܐܡܦܝܪ ܐܝܟ ܠܦܐ ܥܒܕܬܐ ܒܟܠ ܐܠܟܐ ܘܟܘܪܝܐ ܕܟܠ ܐܠܟܐ ܡܢ ܐܠܟܐ ܕܡܬܠܬܐ

$$ܦ : ܟܘ = ١٥ \text{ ܐܘܡ} . ܠ_{١} = \frac{٤}{٣} \text{ ܐܡܦܝܪ} . ܠ_{٢} = \frac{٢}{٣} \text{ ܐܡܦܝܪ}$$

١٣ . ܐ . ܦܘܪܥܢܐ ܕܡܘܙܢܐ ܒܝܢ ܡܘܠܒܐ ܕܟܬܒܐ ٨،٥ ܒܘܠܛ ܐܝܟ ܕܦܪܢܣܐ ܠܥܒܕܐ ܠܦܐ ܡܢܗ ٣ ܐܡܦܝܪ ܘܠܗ ܚܫܒܘ ܒܠܦܐ ٢ ܐܡܦܝܪ ܦܘܪܥܢܐ ܕܡܘܙܢܐ ܥܠ ܗܘܦܘ ܗܘܐ ١١ ܒܘܠܛ ܒܡܐ ܠܗ ܟܘܪܝܐ ܠܓܘܐ ܘܡܡܐ ܠܗ ܚ ܪ ܦ :

ܦ : ٠،٥ ܐܘܡ . ١٠ ܒܘܠܛ

ܦܘܣܩܐ ܬܡܝܢܝܐ ܡܓܢܝܛܝܣܘܬܐ

Magnetism

> ܒܬܪ ܝܠܦܢܐ ܕܐܝܟܐ ܦܣܩܐ ܫܒܝܠܐ ܡܓܢܝܛܝܐ ܡܢ ܒܪ ܒܪܝܬܗ ܘܡܠܘܫܝܬܗ ܘܡܥܒܕܢܘܬܗ ܥܠ ܟܣܘܝܬܐ ܡܥܒܪܢܐ ܠܗ ܘܝܠܦ ܡܫܚܠܦܘܬܐ ܕܟܣܘܝܬܐ ܘܚܫܝܒܘܬܐ ܕܟܣܐ. ܐܦ ܒܬܪ ܫܒܝܠܐ ܡܓܢܝܛܝܐ ܩܠܝܠܐ ܡܢ ܒܪܝܬܐ ܕܠܦܐ ܐܡܝܢܐ ܠܗ ܕܐܠܐ ܡܫܬܝܢܐ ܐܒܝܢܐ ܘܠܦܐ. ܘܒܬܪ ܗܘܠܐ ܕܢܦܘܩܘܬܐ ܡܓܢܝܛܝܬܐ ܕܗܘܠܐ ܘܐܒܝܢܬܗ ܠܦܘܬ ܢܦܘܩܘܬܗ

8 – 1 ܡܓܢܝܛܐ

8 – 2 ܚܝܠܐ ܡܓܢܝܛܝܐ ܒܝܢ
ܬܪܝܢ ܟܣܘܝܬܐ ܡܫܚܠܦܬܐ
ܒܙܘܕܐ ܡܨܘܬܝܬܐ

8 – 3 ܫܒܝܠܐ ܡܓܢܝܛܝܐ

8 – 4 ܣܪܛܐ ܡܓܢܝܛܝܐ

8 – 5 ܚܝܠܐ ܡܓܢܝܛܝܐ ܡܥܒܕܢܐ
ܒܟܣܘܝܬܐ ܡܫܚܠܦܬܐ

8 – 6 ܙܘܓܐ ܕܟܣܘܝܬܐ ܒܗ ܫܒܝܠܐ
ܡܓܢܝܛܝܐ

8 – 7 ܫܘܚܠܦܐ ܕܫܒܝܠܐ ܡܓܢܝܛܝܐ ܕܐܠܐ ܢܒܝܥܐ ܡܢ ܒܗ ܠܦܐ ܟܘܪܟܐ

8 – 8 ܫܘܚܠܦܐ ܕܫܒܝܠܐ ܡܓܢܝܛܝܐ ܕܠܦܐ ܢܒܝܥܐ ܡܢ ܒܗ ܠܦܐ ܟܘܪܟܐ

8 – 9 ܚܘܫܒܐ ܡܓܢܝܛܝܐ ܠܫܠܡܘܬܐ ܡܢ ܒܗ ܠܦܐ ܟܘܪܟܐ ܘܠܚܫܘܒܬܗ ܥܠ
ܚܘܫܒܐ ܕܐܠܟܬܪܘܢ

8 – 10 ܢܦܘܩܘܬܐ ܡܓܢܝܛܝܬܐ (ܢܦ)

8 - 11 ܢܦܘܩܝܘܬܐ ܡܓܢܝܛܝܬܐ ܦܫܝܛܬܐ (ܢܦ ܦ)

8 - 12 ܗܘܠܐ ܡܓܢܝܛܝܐ

8 - 13 ܒܨܝܪܘܬܐ ܡܓܢܝܛܝܬܐ (ܗܝܡܢܘܬܐ ܡܓܢܝܛܝܬܐ)

8 - 14 ܦܪܘܠܝܐ (ܦܪܡܐ)

(٨ ـ ١) ܡܓܢܛܝܣܐ

ܡܕܝܢܬܐ ܕܡܓܢܝܣ ܥܠܬܐ ܗܘܬ ܠܫܘܡܐ ܡܓܢܛܝܣܘܬܐ ܘܡܓܢܛܝܣܐ ܟܐܦܐ ܘܐܬܩܪܝܬ ܕܡܓܢܛܝܣܐ ܐܝܟ ܕܐܡܪܝܢ ܐܢܫܐ ܟܦܪܢܝܘܬܐ ܕܟܘܦܐ ܟܢܘܫܝܐ ܘܠܗ ܡܘܬܒܐ ܕܢܚܫܐ ܘܟܐܦܝܢܐ ܘܛܡܝܪܬܐ ܡܢ ܬܘܦܐ ܡܟܝܠ ܥܠ ܡܓܢܛܝܣܐ ܘܗܘܢܐ ܕܡܫܬܟܚܐ ܒܟܘܦܐ ܟܢܘܫܝܐ ܘܡܬܬܐ ܟܢܘܫܝܐ ܠܐ ܡܛܝ ܕܦܠܚ ܒܗ ܡܓܢܛܝܣܐ.

ܒܬܠܬ ܢܝܫܐ ܡܬܥܒܕܢܘܬܐ ܡܓܢܛܝܣܐ ܡܢ ܫܢܝܐ ܣܓܝܐܐ ܟܕ ܢܛܠܗ ܐܢܐ ܒܫܡܫܐ ܘܩܢܝܗ ܐܝܟܢܐ ܡܬܕܟܝܐ ܟܠܦܐ ܕܡܓܢܛܝܣܐ ܘܡܬܦܬܚ ܠܡܛܪܬܐ ܕܦܪܘܫܐ ܘܒܗ ܚܫܠܬܗ ܒܐܪܥܐ ܕܝܡܡܝܐ ܡܠܚܝܐ. ܘܦܬܠܗ ܗܠܟ ܡܓܢܛܝܣܐ ܚܕܐ ܕܒܘܝܢܐ ܥܠ ܫܢܬܐ ١٦٠٣ ܡ ܘܣܦܠܗ ܒܟܬܒܗ ܕܟܬܒ ܠܠܐ ܘܠܐ ܦܬܠܗ ܢܕܝܕܐ ܐܝܟܢܐ ܕܡܓܢܛܝܣܘܬܐ ܐܠܐ ܐܢܫ ܕܡܬܒܫܠܗ ܢܕܥܐ ܐܘܪܣܛܕ ܒܫܢܬܐ ١٨٢٠ ܡ ܐܚܘܪܐ ܒܝܢ ܠܦܐ ܚܘܪܒܐ ܘܡܬܥܒܕܢܘܬܐ ܡܓܢܛܝܣܐ. ܒܕ ܚܙܠܗ ܦܠܓܬܐ ܕܡܫܚܠܐ ܡܓܢܛܝܣܬܐ ܡܬܒܟܬܐ ܠܒܠ ܐܘ ܠܒܣܗ ܕܐܙܠܐ ܐܘܦܩܢܐ ܫܢܝܐ ܠܠܦܐ ܚܘܪܒܐ. ܐ. ܕܐܙܠܐ ܗܘܐ ܒܚܘܒܐ ܐܘܦܩܢܐ ܠܫܒܝܠܐ ܡܓܢܛܝܣܝܐ ܐܪܟܢܐ ܘܐܘܐ ܫܪܪܐ ܗܘܐ ܡܢ ܫܪܪܐ ܘܣܝܡܬܐ ܡܕܡܝܐ ܥܠ ܗܘܝܬܐ ܕܠܦܐ ܚܘܪܒܐ ܡܬܒܟܐ ܕܫܒܝܠܐ ܡܓܢܛܝܣܝܐ.

ܫܘܦܠܗ ܢܕܥܐ ܐܡܦܝܪ ܒܐܘܐ ܫܒܝܠܐ ܘܡܬܒܫܠܗ ܕܐܝܬ ܒܝܢ ܗܕܝ ܗܐܠܐ ܫܒܝܠܐ ܡܒܘܪܐ ܫܢܝܐ ܠܠܦܐ ܡܬܥܒܕܢܘܬܐ ܡܬܚܠܦܢܬܐ ܠܚܠܒܕ ܡܢܝܗ ܒܐܣܕܪܐ ܘܦܘܫܠܗ ܐܘܐ ܕܚܠܝܗ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܚܕܕܐ ܡܢ ܠܦܐ ܚܘܪܒܐ ܒܗ ܡܬܢܝܢܐ.

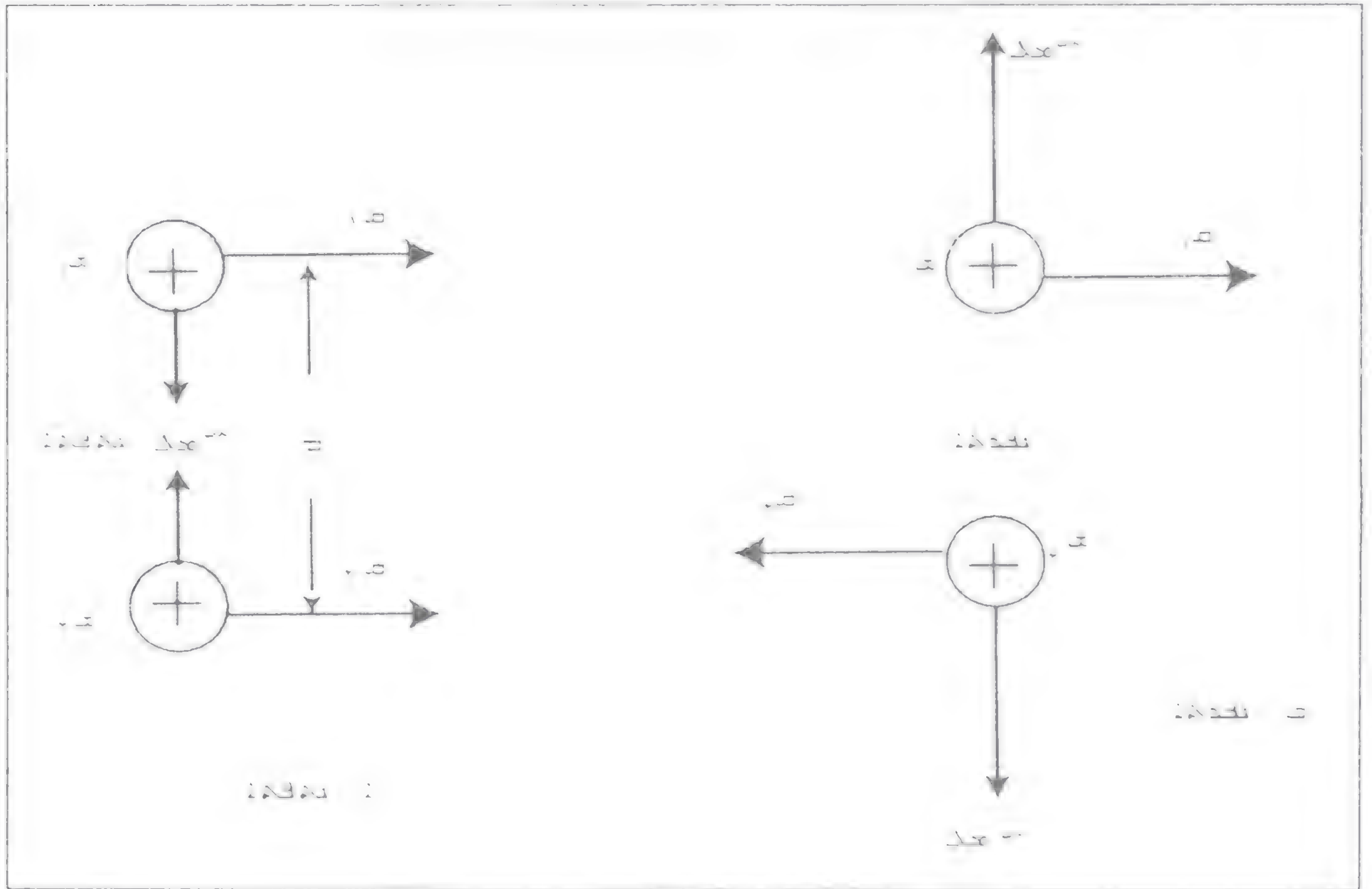
(٨ ـ ٢) ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܒܝܢ ܬܪܝ ܫܘܒܝܢܬܐ ܡܘܚܢܬܐ ܟܗܪܒܝܬܐ ܡܒܘܕܢܬܐ

ܫܘܒܝܢܬܐ ܚܘܪܒܐ ܬܪܬܝ ܒܚܝܠܐ ܕܚܘܪܒܐ (ܚܝܠܐ ܕܟܘܠܘܡ) ܘܫܠܡܝܢ ܠܐܚܘܬܐ:

$$\text{ܚ ܥ ܟܗܦܘܫܐ} = ٩ \times ١٠^{٩} \times \frac{\text{ܩ}_{١}\ \text{ܩ}_{٢}}{\text{ܡ}^{٢}} \quad \ldots\ldots (٨ ـ ١)$$

ܘܡܣܬܟܠ ܢܠܗ ܐܘܐ ܡܢܘܢܐ ܥܠ ܫܘܒܝܢܬܐ ܒܬܪܬܝܢ ܦܘܫܟܐ ܗܘܐ ܐܘ ܠܠܗܘܢ ܐܘ ܡܢ ܕܚܕܐ ܕܠܐ ܒܟܘܡܚ ܕܪܒܐ. ܥܠ ܫܘܒܝܢܬܐ ܦܘܫܟܐ ܒܗ ܡܛܦܠܝ ܝܘܒܠܐ ܕܠܦܐ ܚܘܪܒܐ (ܫܛܝܦܐ).

ܦܬܠܐ ܚܘܝܐ ܒܝܬܝܐ ܕܚܫܘܢܬܐ ܡܘܠܕܢܐ ܐܬܬܪܐ ܟܫܠܐ ܐܫܪܐ ܟܗܘܡ ܡܢ ܚܝܠܐ ܕܒܘܠܦܡ ܘܠܗ ܚܝܠܐ ܡܓܢܛܝܣܝܐ (ܣ ܡܢ) ܒܘܦܩܐ ܟܣܘܡܐ. ܘܟܠܐ ܐܢܘ ܗܦܘܟܐ ܥܠ ܦܠܓܐ ܕܟܘܦܦܐ ܕܐܕܘܢܝ ܚܫܘܢܬܐ ܢܦܘܩܝܐ (ܒ١ ، ܒ٢) ܡܘܠܕܢܐ ܬܐܕܝ ܡܬܘܠܐ ܗܕܘܢܝܐ ܒܘܦܩܐ ܬܒܘܠܦܡ ܘܥܠ ܦܠܓܐ ܕܟܘܦܦܐ ܕܦܠܘܠܦܢܘܗܝ ܡ١ ، ܡ٢ ܚܝܠܐ ܬܦܝܬܐ ܕܦܦܐ ܘܦܦܪܝܬ ܠܗ ܡܕܪܟܐ ܕܒܘܠܟܐ (ܡ). ܬܢ ܐܕܘܢܝ ܚܫܘܢܬܐ ܒܘܦܩܐ ܬܦܝܬܐ ܘܗܘܐ ܐܗܐ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܕܢܬܦܬܐ ܐ. ܐܕܘܢܝ ܚܫܘܢܬܐ ܕܫܬܝ ܗܕܘܢܝܐ ܬܣܝܪ ܙܘܟܐ ܘܕܢܦܬܐ ܐ. ܗܘܝ ܚܫܘܢܬܐ ܕܫܬܐ ܗܕܘܢܝܐ ܬܐܕܝ ܙܘܟܐ ܘܦܟܐ ܐܝܟ ܕܚܙܝܢܢ ܠܗ ܗܘܪܝܐ ܒܨܘܪܬܐ (٨ — ١ ܐ.ܒ).

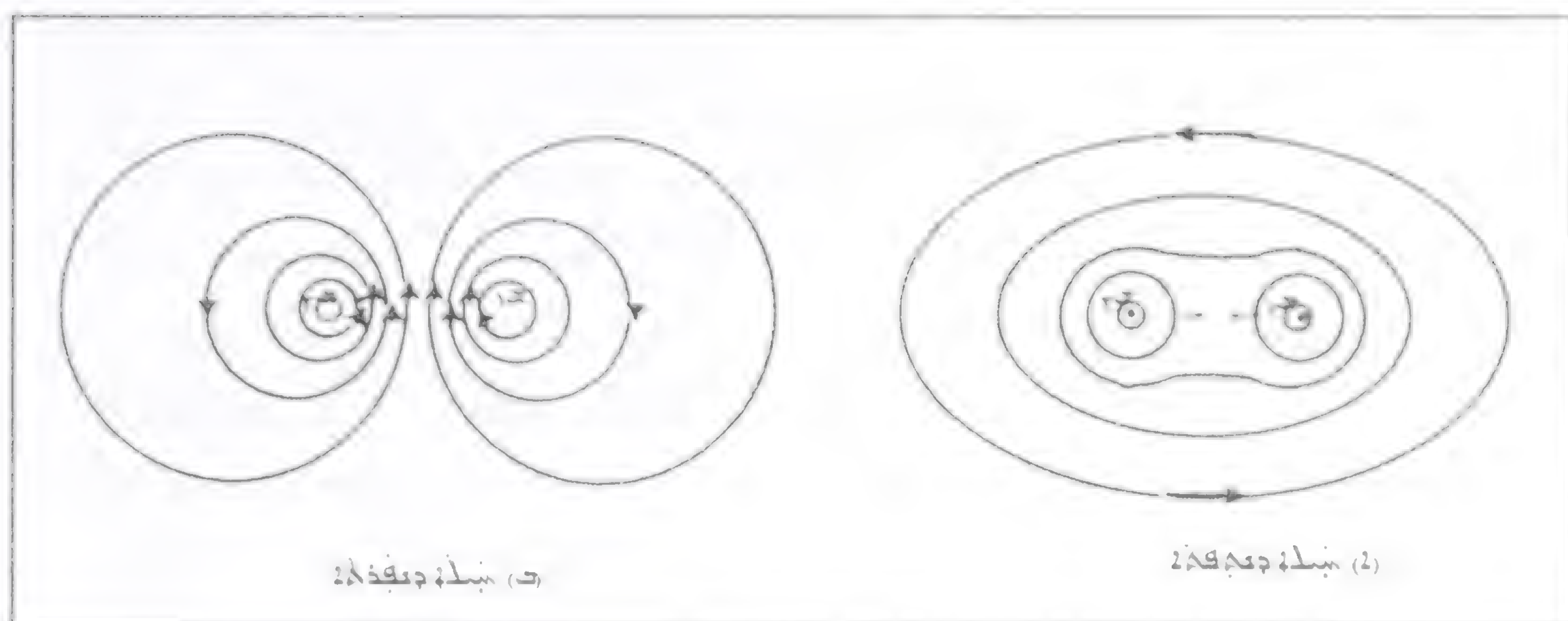


ܨܘܪܬܐ (٨ - ١)

ܘܦܘܫܩܐ ܕܐܗܐ : ܕܚܫܘܢܬܐ ܒܘܪܟܬܐ ܡܬܚܒܠܐ ܡܘܠܕܐ ܚܕܪܘ ܠܚܝܠܐ ܡܓܢܛܝܣܝܐ ܘܐܢ ܙܘܟܐ ܕܐܕܘܢܝ ܚܫܘܢܬܐ ܗܘܐ ܬܙܘܟܐ ܬܢܐܘ ܬܬܪܐ ܡܣܠܘܬܐ ܬܚܝܠܐ ܡܓܢܛܝܣܝܐ ܬܕܘܫܐ ܢܦܠܐ ܬܢ ܐܕܘܢܝ ܚܫܘܢܬܐ ܬܘܝ ܠܚܝܠܗ ܦܬܝ ܝܦܟܐ ܘܐܠܐ ܬܢ ܐܕܘܢܝ ܚܫܘܢܬܐ ܚܝܠܐ ܕܢܬܦܬܐ ܐܨܘܪܬܐ (٨ ـ ٢ܐ).

ܐܠܐ ܐܢ ܙܘܟܐ ܬܢ ܐܕܘܢܝ ܚܫܘܢܬܐ ܗܘܐ ܬܐܕܝ ܙܘܟܐ ܝܦܟܐ ܬܬܪܐ ܚܠܝܬܐ ܠܚܝܠܐ ܡܓܢܛܝܣܝܐ ܬܕܘܫܐ ܢܦܠܐ ܬܢ ܐܕܘܢܝ ܚܫܘܢܬܐ ܬܘܝ ܠܚܝܠܗ ܦܬܝ ܬܙܘܟܐ ܬܢܐܘ ܘܐܠܐ ܬܢ ܐܕܘܢܝ ܚܫܘܢܬܐ ܚܝܠܐ ܕܢܦܬܐ

ܐܝܟ ܕܚܠܠܢܐ ܠܗ ܒܨܘܪܬܐ ܕܦܐܬܐ (٨ ـ ٢ܒ) ܘܐܦܢ ܡܘܚܠܦܬܐ ܠܐܘܐ ܒܡܢܘܬܐ ܕܐܝܬܐ:



ܨܘܪܬܐ (٨ - ٢)

$$\text{ܚ ܡܓܢ ܛܐܘܣܝܐ} = ١٠^{-٧} \times \frac{\text{ܛ}_{١}\,\text{ܛ}_{٢}}{\text{ܪ}^{٢}}\,\text{ܡ}_{١}\,\text{ܡ}_{٢} \quad \text{....} \quad (٨ - ٢)$$

ܐܝܟ ܚܕܝܘܬܐ ܕܫܘܝܐ $١٠^{-٧}$ ܗܝ ܛܐܘܣܝܐ ܒܠܐ $\dfrac{\text{ܢܝܘܛ.\ ܡܛܪܐ}^{٢}}{\text{ܟܘܠܘܡ}^{٢}} = \dfrac{\text{ܢܝܘܛ.}}{(\text{ܐܡܦܝܪ})^{٢}}$

ܘܟܦܠܝܬܐ ܕܫܘܘܠܬܐ ܕܡܢܝܐ (٢) ܥܠ ܫܘܘܠܬܐ ܕܡܢܝܐ (١) ܕܝܗܒܐ ܠܢܘܚ:

$$\frac{\text{ܚ ܡܓܢ}}{\text{ܚ ܟ}} = \frac{١٠^{-٧} \times \dfrac{\text{ܛ}_{١}\,\text{ܛ}_{٢}}{\text{ܪ}^{٢}}\,\text{ܡ}_{١}\,\text{ܡ}_{٢}}{٩ \times ١٠^{٩} \times \dfrac{\text{ܛ}_{١}\,\text{ܛ}_{٢}}{\text{ܪ}^{٢}}}$$

$$\frac{\text{ܚ ܡܓܢ}}{\text{ܚ ܟ}} = \frac{\text{ܡ}_{١}\,\text{ܡ}_{٢}}{٩ \times ١٠^{١٦}} = \frac{\text{ܡ}_{١}\,\text{ܡ}_{٢}}{(٣ \times ١٠^{٨})^{٢}} = \frac{\text{ܡ}_{١}\,\text{ܡ}_{٢}}{\text{ܡܒ}^{٢}}$$

$$\frac{\text{ܚ ܡܓܢ}}{\text{ܚ ܟ}} = \frac{\text{ܡ}_{١}\,\text{ܡ}_{٢}}{\text{ܡܒ}^{٢}} \quad \text{.......} \quad (٨ - ٣)$$

ܟܕ ܡܢ ܝܠܗ ܩܠܝܠܘܬܐ ܕܢܘܗܪܐ ܒܚܠܝܐ ܘܗܝܐ (٣ × ١٠^٨
ܡܝܬܪܐ ܒܪܦܦܐ) ܒܡܕ ܕܐܗܐ ܗܘܐ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܗܦܝܟܐ ܠܛܥܘܢܬܐ ܥܠܝܐ ܐܠܐ
ܒܗܝ ܓܘܢܐ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܘܚܫܡܠܝܐ ܐܝܟ ܕܡܦܠܓܐ ܛܥܘܢܬܐ ܡܘܒܠܢܬܐ
ܠܡܬܠܘܬܐ ܒܗܝ ܡܠܘܠܘܬܐ ܕܚܘܪܐ ܘܝܠܗ ܐܝܬܘܬܐ ܠܐ ܡܫܬܠܗ ܠܡܬܡܠ
ܘܡܠܝܐ ܠܦܘܬ ܓܐܪܫܝܐ ܦܫܝܛܐ. ܦܪܡܐ ܗܘܝ ܡܢ ܕܐܗܐ ܕܚܝܠܐ
ܡܓܢܛܝܣܝܐ ܗܘܝ ܒܝܕ ܬܘܪܐ ܡܢ ܚܝܠܐ ܚܫܡܠܝܐ ܒܡܠܘܠܘܬܐ ܙܥܘܪܐ ܐܝܟ
ܕܝܠܝܐ ܝܠܗ ܓܘܡܠܐ (٨ - ٣).

ܘܐܝܬ ܐܝܬܘܬܐ ܦܫܝܛ ܠܗܘܝ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܠܚܘܕܐ ܪܒܐ ܐܦ ܠܗ
ܡܠܘܠܘܬܐ ܒܘܦܐ ܐܝܟ ܛܥܘܢܬܐ ܡܘܒܠܢܬܐ ܒܡܒܘܥܬܐ ܕܠܦܐ ܚܫܡܠܝܐ ܒܬܐܠܐ.
ܒܐܗܐ ܐܝܬܘܬܐ ܠܝܬ ܦܘܠܚܢܐ ܕܚܩܠܐ ܚܫܡܠܝܐ ܥܠ ܛܥܘܢܬܐ ܒܗܝ ܛܥܘܢܬܐ
ܒܬܐܠܐ ܓܡܘܠܐ ܝܠܗ ܚܫܡܠܝܬܐ ܘܦܫܛ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܠܣܘܪܝܐ ܕܡܟܒܒ
ܥܠ ܛܥܘܢܬܐ ܢܡܘܪܝܬܐ ܡܘܒܠܢܬܐ ܒܡܒܒܘܬܐ ܕܬܐܠܐ ܒܝܢܝܐ ܠܠܦܐ ܘܐܗܐ
ܓܪܫܐ ܝܠܗ ܥܠ ܓܪܝ ܓܐܠܐ ܚܒܒܝ ܠܦܐ ܚܫܡܠܝܐ ܒܕ ܠܝܬ. ܚܩܠܐ ܚܫܡܠܝܐ
ܒܢܓܝܗ ܘܦܫܛ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܒܠܚܘܕ ܕܠܠܝ ܒܐܣܟܡܐ ܕܚܝܠܐ ܕܢܬܦܬܐ
ܐܘ ܢܦܪܬܐ ܒܝܢ ܓܪܫܝܗ ܓܐܠܐ ܠܦܘܬ ܙܘܓܐ ܕܠܦܐ. ܒܫܢܬܐ (١٨٢١ ܡ)
ܡܫܟܚܠܗ ܐܡܦܝܪ ܦܪܢܣܝܐ ܐܡܦܝܪ ܕܐܗܐ ܒܡܝܘܬܐ ܡܓܢܛܝܣܝܬܐ ܕܒܪܝܬܐ
ܝܠܗ ܘܦܫܛ ܒܡܫܚܠܬܐ ܐܘ ܒܡܝܘܬܐ ܠܡܒܪܒܬܐ ܕܐܡܦܝܪ ܐܝܟ ܚܒܝܘܬܐ
ܕܠܦܐ ܚܫܡܠܝܐ ܐܝܟ ܒܕ ܕܪܫܠܗ ܒܬܚܬܝܗ.

(٨ - ٣) ܚܩܠܐ ܡܓܢܛܝܣܝܐ

ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܠܗ ܚܕܐ ܦܫܬܐ ܝܠܗ ܪܘܚܐ ܕܠܠܝ ܠܗܘܝ ܚܝܠܐ
ܡܓܢܛܝܣܝܐ ܡܟܒܒ ܥܠ ܛܥܘܢܬܐ ܚܫܡܠܝܬܐ ܡܘܒܠܢܬܐ ܐܘ ܡܓܢܛܝܣܐ ܕܐܝܬ
ܒܐܗܐ ܪܘܚܐ. ܘܟܪܒܐ ܕܗܘܐ ܐܗܐ ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܦܠܝܛܐ ܡܢ ܛܥܘܢܬܐ
ܡܘܒܠܢܬܐ ܐܚܪܬܐ ܐܘ ܡܢ ܡܓܢܛܝܣܐ ܥܠܝܐ ܐܘ ܡܘܒܠܢܐ.

ܒܕܠܠܝ ܕܚܫܘܚܐ ܕܚܝܠܐ ܚܫܡܠܝܐ ܒܝܢ ܓܪܝ ܛܥܘܢܬܐ ܚܕܐ ܡܢܝܗ
ܦܫܘܛܐ ܘܐܚܪܬܐ ܠܠܦܘܬܐ ܒܪܝ ܡܢ ܛܥܘܢܬܐ ܦܫܘܛܐ ܘܦܪܫܝ ܒܛܥܘܢܬܐ
ܠܠܦܘܬܐ ܒܡܕ ܕܐܗܐ ܝܠܗ ܚܫܘܚܐ ܙܠܡܢܝܐ ܠܐ ܕܒܥܕܐ ܐܦ ܦܫܛ ܠܦܘܦܝܐ
ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܒܚܫܘܚܐ ܙܠܡܢܝܐ ܐܠܐ ܝܠܗ ܕܒܥܕܐ ܒܡܕ ܕܐܗܐ ܠܐ ܝܠܗ

ܡܬܢܛܪܐ ܗܢܐ ܥܠ ܗܘܠܟܐ ܡܓܢܝܛܝܣܝܐ ܠܗܘܕܐ ܠܟܪܣܐ ܐܘ ܠܡܪܥܐ ܘܦܝܫ
ܗܕܐ ܫܦܥܐ ܕܚܝܠܐ ܡܓܢܝܛܝܣܝܐ ܡܟܣܘܝܠ

(٨ - ٤) ܫܦܥܐ ܡܓܢܝܛܝܣܝܐ (ܫܦ) ܘܚܣܝܢܘܬܐ ܕܫܦܥܐ ܡܓܢܝܛܝܣܝܐ (ܚܫܦ)

ܡܢܝܢܐ ܕܚܘܛܐ ܡܓܢܝܛܝܣܝܐ ܥܒܪܝܢ ܠܥܒܪܐ ܡܢ ܟܠ ܚܕܐ ܫܛܝܚܘܬܐ ܡܢ ܕܘܟܐ ܦܝܫ ܗܕܐ ܒܫܦܥܐ ܡܓܢܝܛܝܣܝܐ (ܫܦ) ܘܦܝܫ ܟܝܠܐ ܒܫܘܡܗܐ ܦܝܫܐ ܗܕܝܐ (ܘܒܪ) ܘܚܕ ܘܒܪ ܫܘܐ ١٠ ^٨ ܡܟܣܘܝܠ.

ܡܢܝܢܐ ܕܚܘܛܐ ܡܓܢܝܛܝܣܝܐ ܥܒܪܝܢ ܠܡܥܒܪܢܐ ܡܢ ܟܠ ܚܕܘܬܐ ܕܫܛܝܚܘܬܐ ܦܝܫ ܗܕܐ ܒܚܣܝܢܘܬܐ ܕܫܦܥܐ ܡܓܢܝܛܝܣܝܐ.

$$ܚܫܦ = \frac{ܫܦܥܐ\ ܠܡܥܒܪܢܐ}{ܫܛܝܚܘܬܐ}$$

ܘܦܝܫܐ ܒܟܠܗܝܢ ܚܣܝܢܘܬܐ ܕܫܦܥܐ ܡܓܢܝܛܝܣܝܐ $\frac{ܒܘܒܪ}{ܡܛܪ^{٢}}$ ܘܦܝܫܐ ܗܕܝܐ

ܛܣܠܐ (ܛ) ܒܫܘܡܗܐ ܗܕܝܐ ܟܠܗ ܕܦܩܦܐ ܐܠܐ ܒܫܘܡܗܐ ܗܢ ܟܠܗ ܕܦܩܦܐ ܦܝܫܐ ܒܡܫܘܚܬܐ ܚܫܦ $\frac{ܡܟܣܘܝܠ}{ܣܡ^{٢}}$ ܘܦܝܫܐ ܗܕܝܐ ܐܘ ܚܕܘܬܐ (ܓܐܘܣ) ܘܚܕ ܓܐܘܣ ܫܘܐ ١٠ ^٤ ܛܣܠܐ ܟܕ ܥܒܪ ܡܢܗ ܚܕ ܚܘܛܐ ܡܓܢܝܛܝܣܝܐ ܠܡܥܒܪܢܐ ܡܢ ܟܠ ܫܛܝܚܘܬܐ ܫܘܝܐ ١ ܣܡ^{٢}.

ܘܒܪ = ١٠ ^٨ ܡܟܣܘܝܠ ܐܝܟ ܕܝܕܥܝܢ ܒܪܟܒܐ.

$$ܛܣܠܐ = \frac{ܘܒܪ}{ܡܛܪ^{٢}} = \frac{١٠^{٨}\ ܡܟܣܘܝܠ}{١٠^{٤}\ ܣܡ^{٢}} = \frac{١٠^{٤}\ ܡܟܣܘܝܠ}{ܣܡ^{٢}} = ١٠^{٤}\ ܓܐܘܣ$$

ܚܝܠܐ ܡܓܢܝܛܝܣܝܐ ܕܐܪܥܐ ܒܦܢܝܬܐ ܕܝܠܗ ܕܡܕܢܚܐ ܠܗ ܒܗܝ ܦܢܝܬܐ ܕܐܠܦܘܢܐ ܘܣܪܪܐ ܗܘܐ ܐܝܟ ٤ ١ ܛܣܠܐ ܐܠܐ ܐܢ ܦܝܫ ܚܝܠܐ ܡܓܢܝܛܝܣܝܐ ܠܟܠ ٣ ١٠ $^{-٥}$ ܛܣܠܐ ܐܠܐ ܚܝܠܐ ܡܓܢܝܛܝܣܝܐ ܡܗܘܝܐ ܕܡܓܢܝܛܝܣܐ ܢܝܢܐ ܚܝܠܐ ܝܠܗ ܐܝܟ ١٠ ܛܣܠܐ ܐܠܐ ܟܠ ܒܗ ܢܘܦܐ ܠܗܘܕܐ ܡܕܢܝܐ ١٠٠ ܛܣܠܐ

(٨ - ٥) ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܡܥܒܕܢܐ ܥܠ ܟܣܘܝܬܐ ܡܙܝܥܢܝܬܐ

ܐܢ ܙܠܝܠܐ ܟܣܘܝܬܐ ܢܘܩܕܢܝܬܐ ܒܡܠܠܐ (ܫ) ܒܡܠܘܐ ܒܩܠܝܠܘܬܐ (ܩ) ܡܬܐܪܐ: ܕܦܦܐ ܒܓܘ ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܚܝܘܬܐ ܕܛܘܦܣܗ (ܚܙܬܦ) ܒܚܝܠܐ ܒܡܒܥܒܕܐ ܒܚܝܠܐ (ܚ) ܢܘܩܕ. ܒܡܘܕܢܐ ܥܠ ܬܘܪܐ ܕܫܒܝܠܗ. ܚܙܬܦ ܕܙܘܝܬܐ ܒܝܢܬܗܘܢ ܗܘܝܐ ܗ ܘܦܝܫܠܗ ܡܕܝܢܐ ܐܗܐ ܚܝܠܐ ܒܚܝܠܐ ܕܠܘܪܢܙ.

ܨܘܪܬܐ (٨ - ٣ܐ)

ܚ = ܫ . ܩ × ܚܙܬܦ

ܘܦܝܫ ܡܘܟܒܕܐ ܒܐܚܝܢܘܬܐ

ܚ = ܫ ܩ ܚܙܬܦ ܣܝܢ ܗ ...... (٨ – ٤)

ܟܕ ܗ ܙܘܝܬܐ ܒܝܢ ܚܙܬܦ ܘ ܩ

ܚܝܠܐ ܕܠܘܪܢܙ ܗܘܐ ܡܡܘܕܢܐ ܥܠ ܟܠ ܚܕ ܡܢ ܨܘܪܬܐ ܕܩܠܝܠܘܬܐ ܘܨܘܪܬܐ ܕܚܙܩܐ ܡܓܢܛܝܣܝܐ.

ܨܘܪܬܐ ܕܚܝܠܐ ܕܠܘܪܢܙ (ܚ) ܡܫܟܚܠܗ ܐܝܟ ܕܐܝܕܐ ܝܡܝܢܐ ܕܐܡܪ ܐܢ ܦܬܚܠܠܗ ܨܒܥܬܐ ܕܐܝܕܐ ܝܡܝܢܐ ܒܟܘܢ ܡܢ ܒܪܬܐ ܠܗ ܨܘܪܬܐ ܕܩܠܝܠܘܬܐ (ܩ) ܕܟܣܘܝܬܐ ܡܘܡܝܬܐ ܨܘܒ ܚܝܘܬܐ ܕܛܦܣܐ (ܚܙܬܦ) ܒܙܘܝܬܐ (ܗ) ܨܘܪܬܐ ܕܒܪܬܐ ܒܕܡܘ ܠܨܘܪܬܐ ܕܚܝܠܐ ܕܠܘܪܢܙ (ܚ) ܐܝܟ ܕܡܠܝܐ ܒܗ ܨܘܪܬܐ (٨ - ٣ ܒ . ܓ).

ܨܘܪܬܐ (٨ - ٣) ܐܝܕܐ ܕܐܝܕܐ ܝܡܝܢܬܐ

(٨ - ٦) ܙܘܥܐ ܕܟܣܘܝܬܐ ܓܘ ܓܒܝܠܐ ܡܓܢܛܝܣܝܐ

ܐܢܐ ܐ. ܙܒܠܐ ܟܣܘܝܬܐ ܟܡܠܘܠܘܬܐ (ܩ) ܒܡܘܙܓܬܐ ܥܠ ܙܘܝܐ ܕܟܦܦܐ ܡܓܢܛܝܣܝܐ ܕܚܝܠܘܬܐ ܕܟܦܦܐ ܚܙܩ ܟܘܢܐ ܟܡܟܟܕܢܘܬܐ ܕܚܝܠܐ ܕܠܦܪܢܝ ܕܟܝܪ ܚܘܝܟܢܐ ܡܢ ܗܘܡܠܬܐ ܚ = ܟ ܩ ܚܙܩ. ܘܟܕ ܐܗܐ ܚܝܠܐ ܒܡܘܙܓܐ ܥܠܗ ܥܠ ܙܘܝܐ ܕܙܘܥܐ ܕܟܣܘܝܬܐ ܐܡܢܝܐ ܘܡܫܢܝܬܐ ܕܟܘܠܐ ܠܡܫܚܘܬܐ ܕܓܒܝܠܐ ܡܓܢܛܝܣܝܐ ܟܘܕ ܕܐܗܐ ܐܗܐ ܟܣܘܝܬܐ ܟܦܕܬܠܐ ܟܡܙܘܠܐ ܚܘܕܢܐ ܟܡܟܟܕܢܘܬܐ ܕܚܝܠܐ ܕܠܦܪܢܝ ܡܟܟܕܢܐ ܟܐܗܐ ܟܣܘܝܬܐ ܐܚܡܙܐ (٨ – ٤).

ܘܡܘܬܕܢܬܐ ܥܠܗ ܕܡܫܘܚ ܕܐܠܟܬܘܦ. ܐ. ܟܟܕܠܗ ܓܘ ܓܒܝܠܐ ܡܓܢܛܝܣܝܐ ܡܓܠܡܐ ܟܡܠܘܠܘܬܐ (ܩ) ܒܡܘܙܓܬܐ ܥܠ (ܚܙܩ) ܐܠܟܬܘܦ. ܟܐܟܪ ܡܙܘܠܐ ܚܘܕܢܐ ܘܟܦܠܓܐ ܕܡܓܠܕܐ ܘܟܦܪ ܟܙܘܥܐ ܘܦܟܢܐ ܠܙܘܥܐ ܕܦܕܘܬܘ. ܟܟܠܬܐ ܕܦܘܕܢܝܗ ܟܐܕܢܐ ܕܟܣܘܝܬܐ.

ܐܚܡܙܐ (٨ - ٤) ܡܫܘܐ ܕܟܣܘܝܬܐ ܟܦܕܬܠܐ ܟܡܙܘܠܐ ܚܘܕܢܐ

ܐܢܐ ܐ. ܠܐ ܗܘܐܠܗ ܡܠܘܠܘܬܐ ܝܕܥܬܐ (ܩ) ܕܟܣܘܝܬܐ ܒܡܘܙܓܬܐ ܥܠ ܓܒܝܠܐ ܡܓܢܛܝܣܝܐ ܙܘܥܐ ܠܐ ܗܘܐ ܚܘܕܢܝܐ ܐܠܐ ܐܘܦܬܢܝܐ (Helical path) ܐܚܡܙܐ (٨ - ٥).

ܐܚܡܙܐ (٨ - ٥)

ܡܘܦܬܐ

ܢܬܠܘ ܠܡܬܩܢܬܐ ܒܫܘܟܡܗ +٣ ܡܝܟ ܒܡܠܘܠܘܬܐ ܕܡܫܠܐ ٣٠ ܡ ܕܩ ܒܗ ܒܚܝܠܐ ܡܓܢܛܝܣܝܐ ܚܣܝܢܬܐ ܕܬܩܦܗ ٥ ܛܣܠܐ ܡܫܐ ܚܠܘ ܒܡܫܠܐ ܕܚܝܠܐ ܠܡܪܕܘܬܐ ܟܕ ܗܘܐ:

١) ܐܡܬܝ ܕܠܡܬܩܢܐ ܒܡܫܘܘܬܐ ܕܣܪܛܘܛܐ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ.

٢) ܐܡܬܝ ܕܠܡܬܩܢܐ ܡܫܘܓܪܐ ܥܠ ܣܪܛܘܛܐ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ.

ܫܪܝܐ

ܚ = ܫ ܡ ܣܝ ܫܦ ܓܒ ܗ

١) ܚ = +٣ × ١٠$^{-٦}$ × ٣٠ × ٥ × ܓܒ ܣܦܪܐ = ܣܦܪܐ

٢) ܚ = +٣ × ١٠$^{-٦}$ × ٣٠ × ٥ × ܓܒ ٩٠ = ٤٥ × ١٠$^{-٥}$ ܢܝܘܛܢ.

(٨ ـ ٧) ܬܘܠܕܐ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ ܒܐܝܕܐ ܢܓܕܐ ܚܫܡܠܝܐ ܒܗ ܠܦܐ ܕܣܘܪܟܐ

ܒܫܢܬ ܕܐܬܚܙܝ ܡܢ ܡܬܚܫܒܢܐ ܕܐܘܪܣܛܕ ܒܫܢܬܐ ١٨٢٠ ܡ ܕܝ ܒܚܝܕܘܬܗ ܠܦܐ ܕܣܘܪܟܐ ܒܗ ܡܬܚܫܒܢܐ ܒܟܬܪܐ ܚܕܪܘ ܠܚܝܠܐ ܡܓܢܛܝܣܝܐ ܡܬܚܙܐ ܦܠܓܘܬܐ ܕܡܫܚܠܐ ܕܣܘܡܟܐ ܫܒܝܠܐ ܠܗܘܐ ܐܦܠܐ.

ܘܡܬܚܙܐ ܠܗ ܢܓܕܐ ܦܪܝܫܐ ܐܡܝܕ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ ܗܘܐ ܒܐܡܬܚܙܐ ܕܘܪܢܬܐ ܡܫܘܝܐ ܕܡܣܓܪܘ. ܡܣܬܪܘܢܝܢ ܒܡܘܬܐ ܕܚܟܪܬܐ ܕܠܦܐ ܘܡܩܘܝܢ ܡܫܘܓܪܐ ܥܠ ܡܐܢܐ ܕܠܦܐ ܒܐܝܟ ܡܬܚܙܝܢܐ ܐܝܟ ܒܐܡܬܚܙܐ (٨ ـ ٦) ܘܡܬܩܒܠܐ ܐܡܝܕ ܐܝܟ ܕܢܩܘܪܐ (Screw Driver Rule)

ܨܘܪܬܐ (٨ ـ ٦)

ܡܫܘܐ ܙܘܪܐ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ ܚܙܝ ܗܘܠܐ ܗܕܝܪܐ ܟܪܟ ܒܗ ܠܦܐ ܕܘܕܪܢܐ ܘܐܣܟܡܐ (٨ - ٧) ܚܠܠܐ ܠܗ ܠܗܘܐ.

ܐܣܟܡܐ (٨ - ٧)

ܐ. ܒܕܪܟ ܠܗܘܠܐ ܒܐܝܕܐ ܝܡܝܢܐ ܐܝܟ ܕܒܕܪܐ ܕܗܘܐ ܠܙܘܪܐ ܕܠܦܐ ܕܘܕܪܢܐ ܙܘܪܐ ܕܠܦܐ ܕܨܒܝܬܐ ܕܝܕܥܐ ܒܕܗܘܝ ܠܙܘܪܐ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ.

ܡܬܬܠܝܗ ܡܕܡܝܐ (ܐܡܦܝܪ) ܘ(ܒܝܘ ܣܘܪܐ) ܒܝܕ ܕܪܐ ܝܡܝܢܐ ܕܡܬܠܐ ܕܫܘܝܐ ܕܢܦܩܐ ܡܓܢܛܝܣܝܐ (ܚܝܠ ܣܘܡܐ) ܒܡܘܫܚܬܐ ܥܠ ܡܕܒܪܐ (ܡ) ܡܕܒܪܐ ܡܢ ܗܘܠܐ ܝܕܝܥܐ ܟܪܟ ܒܗ ܠܦܐ ܕܘܕܪܢܐ ܡܬܠܘ (ܠ) ܐܡܦܝܪ ܦܫܛ ܗܕܫܢܝܗ ܥܡ ܠܦܐ ܘܦܓܥܝܢ ܥܡ ܡܕܒܪܐ (ܡ) ܒܕ ܚܝܠ ܣܘܡܐ ∝ $\frac{ܠ}{ܡ}$ ܘܦܥܠܐ ܡܬܒܝܢܐ ܗܘܒܕܝܢ ܕܡܫܚܬܐ ܕܫܘܝܘܬܐ ܗܘܐ

$$٢ \times ١٠^{-٧} \frac{\text{ܘܒܪܐ}}{\text{ܐܡܦܝܪ . ܡܕܪܐ}}$$

$$\text{ܚܝܠ ܣܘܡܐ} = ٢ \times ١٠^{-٧} \times \frac{ܠ}{ܡ} \quad \ldots\ldots\ldots\ldots\ldots\ (٨ - ٥)$$

ܚܝܠܐ ܒܝܢ ܬܪܝ ܠܦܐ

ܠܡܚܘܝܘ ܕܚܝܠܐ ܕܡܬܚܫܐ ܐܘ ܢܦܩܐ ܒܝܢ ܬܪܝܢ ܗܘܠܐ ܡܬܘܢܝܐ ܒܫܘܘܝܐ ܦܪܝܫܝܢ ܒܡܕܒܪܐ (ܡ) ܟܪܟ ܒܚܕ ܡܢܗܘܢ ܠܦܐ (ܠ١) ܘܒܐܚܪܢܐ (ܠ٢) ܠܦܐ ܕܘܕܪܢܐ ܠ٢ ܒܪܕܝܐ ܒܗܘܠܐ ܗܕܝܪܐ ܗܘܠܟ ܫܘܝܐ ܕܢܦܩܐ ܡܓܢܛܝܣܝܐ

(ܚܝܥܦ ٢) ܒܗܘܦܟܐ ܢܦܠܐ ܥܠ ܗܐܠܐ ܡܕܡܝܐ ܘܒܒܕܐ ܡܢ ܗܐܠܐ ܗܕܢܝܐ ܒܗܘܒܕܐ (ܕ) ܘܒܢܘܬܐ ܠܡܘܕܝܐ ܥܠ ܠܦܐ ܒܗܐܠܐ ܡܕܡܝܐ ܘܗܘܐ ܚܠܐ (ܚ) ܡܒܒܕܢܐ ܥܠ (ܚ) ܡܒܗܕܐ ܡܢ ܡܘܕܒܐ ܕܗܐܠܐ ܡܕܡܝܐ ܐܝܟ ܕܐܬܐ:

ܚ = ܠ١ ܡܪ . ܚܝܥܦ ܡܓܢܛܝܣܝܐ (ܘܐܝܬ ܝܕܐ ܒܚܠܐ ܕܐܡܦܝܪ)

$$\text{ܘܒܡܣܠܦܬܐ ܝܠܒ}\quad 2 \times 10^{-7} \times \frac{ܠ_2}{ܕ}$$

$$ܚ = 2 \times 10^{-7} \times \frac{ܠ_1\ ܠ_2 \times ܡܪ}{ܕ} \qquad (8 - 6)$$

ܡܘܬܒܠܘ ܠܐܗܐ ܐܣܬܘܐܕܐ ܢܕܘܟܐ ܦܕܢܝܐ ܐܡܦܝܪ ܘܒܡܘܕܐܠܘ ܕܚܠܐ ܕܢܗܦܟܐ ܐܘ ܢܦܕܟܐ ܒܝܢ ܬܪܝܢ ܗܐܠܐ ܡܒܘܢܐ ܒܗܘܒܕܐ ܒܝܢܬܝܗܘܢ (ܕ) ܠܚܕܐ ܒܚܕ ܡܢܗ ܠܦܐ (ܠ١) ܘܒܐܣܕܢܐ (ܠ٢) ܦܝܫ ܐܬܡܢܝܐ ܥܠ ܦܠܛܐ ܕܒܗܘܦܦܐ ܕܠܦܐ ܘܒܥ ܡܘܕܒܐ ܕܡܢܬܐ ܒܐܡܘܒܠܝܬܐ ܡܢܗ ܘܦܟܐܝܬ ܥܠ ܒܗܘܒܕܐ ܒܝܢܬܝܗܘܢ.

ܘܐ. ܗܕܘܢܗ ܠܦܐ ܠ١ ، ܠ٢ ܗܘܝ ܒܓܘܒܢܐ ܒܝܬܘ ܒܗܘܐ ܚܠܐ ܡܩܢܛܝܣܝܐ ܡܗܠܦܢܐ ܒܝܢ ܗܕܘܢܗ ܗܐܠܐ (ܚ) ܕܢܗܦܟܐ ܐܚܙܝ ܐܚܙܝܐ (٨ ـ ٨).

ܐܠܐ ܐܢ ܗܕܘܢܗ ܠܦܐ ܗܘܝ ܒܓܘܒܢܐ ܦܟܝܢܐ ܐܗܐ ܚܠܐ ܕܒܝܢܬܝܗܘܢ (ܚ) ܒܗܘܐ ܕܢܦܕܟܐ ܒܕ (ܚ) ܚܠܐ ܡܒܒܕܢܐ ܒܡܢܬܐ ܕܡܘܕܒܐ (ܡܪ) ܕܡܢ ܗܕܘܢܗ ܗܐܠܐ ܐܝܟ ܕܒܐܚܙܝܐ (٨ ـ ٨).

ܐܚܙܝܐ (٨ ـ ٨)

(٨ ـ ٨) ܣܘܦܠܬܐ ܕܫܒܝܠܐ ܡܓܢܛܝܣܝܐ ܕܠܦܦܐ ܢܪܒܓܐ ܥܒܪ ܒܗ ܠܦܐ ܕܘܪܒܐ

ܒܫܠܡ ܕܡܫܡܫܡ ܕܐ. ܫܡܕܠܘ ܠܦܐ ܕܘܪܒܐ ܓܘ ܠܦܐ ܡܓܘܢܐ ܠܦܐ ܕܦܠܣ ܦܘܠܣܢܐ ܕܟܡܐ ܡܘ ܓܝܓܐ ܕܒ ܗܘܐ ܡܕ ܟܕܝ ܡܘܓܕܐ ܣܕ ܡܢܝܗ ܓܕܫܢܐ (ܓ) ܦܠܓܝ ܡܢܘ ܣܓܘܓܐ ܕܣܠܐ ܡܓܢܛܝܣܝܐ ܘܣܕܪܐ ܟܡܢܢܐ (ܐ) ܫܡܕܝ ܓܠܘܗ ܣܓܘܓܐ ܕܣܠܐ ܡܓܢܛܝܣܝܐ ܟܘܡܡܐ ܕܘܕܟܝܗ ܓܘ ܠܦܐ ܟܡܠܐ ܕܘܕܟܝܗ ܕܡܕܟܐ ܓܘ ܠܦܐ ܘܠܕܒ ܡܢܘ ܘܕܐܘܕܫܐ ܕܒ ܕܕܝܟܐ ܘܦܟ ܡܘܦܠܫܐ ܐܝܕܐ ܕܐܝܕܐ ܝܡܝܢܐ ܕܠܦܦܐ (ܐܘ ܐܝܕܐ ܕܣܠܘܠܐ ܠܟܣܝܕܐ ܕܡܘܓܕܘ ܐܣܝ ܒܐܨܒܥܬܐ (٨ ـ ٩ܐ . ܒ . ܓ).

ܨܘܪܬܐ (٨ ـ ٩ܐ) ܫܒܝܠܐ ܡܓܢܛܝܣܝܐ ܕܠܦܐ ܥܒܪ ܒܠܦܦܐ ܢܪܒܓܐ	ܨܘܪܬܐ (٨ ـ ٩ܒ) ܓܠܝܐ ܝܠܘ ܐܝܕܐ ܕܐܝܕܐ ܝܡܝܢܝܐ ܕܠܦܦܐ

ܨܘܪܬܐ (٨ ـ ٩ܓ) ܫܒܝܠܐ ܡܓܢܛܝܣܝܐ ܕܠܦܦܐ ܡܓܘܢܐ

ܘܗܘܐ ܚܝܘܬܐ ܕܙܪܡܐ ܡܫܢܝܢܝܬܐ ܠܐ ܠܝܬܐ ܕܟ ܡܢ ܡܐ ܕܠܗ ܗܠܗ ܠܟܐ ܡܢܗ ܒܝܠܬܐ ܕܫܒܝܪܬܐ ܕܐܢܐ ܣܠܘܩܐ.

ܘܠܫܒܝܬܐ ܕܙܪܡܐ ܡܫܢܝܢܝܬܐ ܣܘܪܩ ܠܗ ܠܝܬܐ ܐܘܦܝܐ ܢܪܒܐ ܡܙܒܢܐ ܗܠܗ ܡܫܘܚܬܐ ܕܐܘܪܢܝܬܐ ܕ :

$$\text{ܚܙ} = \text{ܢܟ ܣܘܡܐ} \times \frac{\text{ܡܟ} \times \text{ܠ}}{\text{ܡܪ}} \qquad (٨ - ٧)$$

ܡܟ : ܡܢܝܢܐ ܕܠܝܬܐ . ܡܪ = ܡܘܪܒܐ ܕܠܝܬܐ . ܚܙ . ܣܘܪܩܐ ܕܙܪܡܐ ܒܡܫܚܬܗ . ܕܠܝܬܐ

$$\text{ܡܟ} = \frac{\text{ܡܟ}}{\text{ܡܪ}} = \frac{\text{ܡܢܝܢܐ ܕܠܝܬܐ ܕܠܝܬܐ}}{\text{ܡܘܪܒܐ ܕܠܝܬܐ}} \quad \text{ܡܟ} = \text{ܡܢܝܢܐ ܕܠܝܬܐ ܠܡܪܘܬܐ ܕܡܘܪܒܐ}$$

$$\text{ܚܙ ܣܘܡܐ} = ٤ ٫ ٠ \times ١٠^{-٢} \frac{\text{ܘܡܪܐ}}{\text{ܐܣܦܪ ܡܪܬܐ}} \text{ ܡܟ} \times \text{ܠ ܐܣܦܪ} \quad (٨ - ٨)$$

ܘܡܘܩܠܬܐ (٨ ـ ٨) ܡܫܘܚܐ ܣܘܪܩ ܠܐ ܐܬܠܐ ܥܠ ܡܢܝܢܐ ܕܠܝܬܐ ܐܘ ܡܘܪܒܐ ܕܠܝܬܐ ܡܫܚܠܦܢܐ ܢܪܒܝܐ ܘ ܣܘܪܩ ܡܫܬܢܐ ܕܡܘܠܐ ܗܠܗ ܠܗ ܢܘܩܙܐ ܕܡܩܒܠܢܐ ܦܪܘܫܐ ܚܠܝܡ ܘܗܠܗ ܐܚܝܢܘܬܐ ܡܘܪܒܬܐ.

ܬܘܦܣܐ (١)

ܐܫܟܚ ܢܘܩܙܐ ܣܘܪܩ ܣܘܡܐ ܠܝܬ ܢܘܩܙܐ ܒܠܒܐ ٥ ܡܟ ܡܢ ܐܬܐ ܠܝܬ ܠܝܬܐ ܒܡܘܠܐ (٢٠ ܡܟ)

ܫܪܝܐ

$$\text{ܣܪ ܢܟ ܣܘܡܐ} = ٢ \times ١٠^{-٢} \times \frac{\text{ܠ}}{\text{ܡ}}$$

$$ܚܝ\ ܬܟ\ ܡܓܢܛܝܣܝܐ = ٢ \times ١٠^{-٧} \times \frac{ܘܝܒܪ}{ܐܡܦ\ \ ܡܝܬܪ} \times \frac{٢٠\ ܐܡܦ}{} = ٠ \times ١٠^{-٤}\ ܛܣܠܐ$$

$$ܚܝ\ ܬܟ\ ܡܓܢܛܝܣܝܐ = ٨,٠ \times ١٠^{-٤} = ٠,٨ \times \frac{ܘܝܒܪ}{ܡܝܬܪ^{٢}} \times ١٠^{-٤}\ ܛܣܠܐ$$

$$\frac{ܘܝܒܪ}{ܡܝܬܪ^{٢}} = ܛܣܠܐ = ١٠^{٤}\ ܓܘܣ$$

$$٠,٨ \times ١٠^{-٤} \times ١٠^{٤} = ٠,٨\ ܓܘܣ$$

ܛܘܦܣܐ (٢)

ܠܘܦܐ ܡܠܘܢܝܐ ܠܟܝܗ ܦܘܫܐ ܡܢܝܢܐ ܕܠܦܦܗ ١٠٠ ܘܢܘܓܪܗ ٢٠ ܣܡ ܐܢܐ ܠܦܐ ܒܘܢܝܗ (٤ ܣܡ) ܦܫܐ ܢܝܗ:

١ . ܚܝܘܬܐ ܕܝ ܦܠܐ ܡܓܢܛܝܣܝܐ ܓܘ ܠܒܐ (ܓܒܝ ܡܨܥܝܐ ܕܠܒܐ).

٢ . ܬܦܠܐ ܡܓܢܛܝܣܝܐ ܕܡܫܠܛܐ ܦܘܫܐ ܡܠܘܢܝܐ ܓܒܝ ܡܢܝܢܗ ܐ. ܡܢܝܢܐ ܕܡܫܠܛܐ ܕܠܒܐ ٢ ܣܡ.

ܫܪܝܐ

$$ܚܝ\ ܬ = ܬܟ\ ܡܓܢܛܝܣܝܐ \times \frac{ܡܢ \times ܠ}{ܢ}$$

$$= ٤ \times ١٠^{-٧} \times \frac{١٠٠ \times ٤\ ܐܡܦ}{٠,٢\ ܡܝܬܪ} = ٢,٥ \times ١٠^{-٣}\ \frac{ܘܝܒܪ}{ܡܝܬܪ^{٢}}$$

$$ܚܝ\ ܡܓܢܛܝܣܝܐ = ٢,٥ \times ١٠^{-٣}\ ܛܣܠܐ$$

٢ . ܬܦܠ = ܬܚܝܘܬܐ ܢܦܘܩܬܐ ܕܡܫܠܛܐ ܦܘܫܐ

$=$ ܦܫ^{2} ܛ $= (1) \times 10^{-4}$ ܡܝܬܪ$^{2} \times 3.14$

ܫܛ $= 3.14 \times 10^{-4}$ ܡܝܬܪ^{2}

ܝܘܩܪܐ (ܬ) = ܣܝܬ ܫܛ

$$= 2.5 \times 10^{-3} \frac{\text{ܘܝܒܪ}}{\text{ܡܝܬܪ}^{2}} \times 3.14 \times 10^{-4} \text{ ܡܝܬܪ}^{2}$$

ܬ $= 7.85 \times 10^{-7}$ ܘܝܒܪ

ܐܠܐ (1) ܘܝܒܪ $= 10^{8}$ ܡܟܣܘܝܠ

ܬ $= 7.85 \times 10^{-7} \times 10^{8} = 78.5$ ܡܟܣܘܝܠ

(٨ - ٩) ܣܘܪܛܐ ܡܓܢܛܝܣܝܐ ܕܚܝܠܐ ܫܩܝܠܐ ܟܕ ܠܦܐ ܕܘܪܢܐ ܘܡܫܘܚܬܗ ܥܠ ܣܘܪܛܐ ܕܐܠܩܛܪܘܢ

ܐ. ܟܕ ܠܦܐ ܕܘܪܢܐ ܕܚܝܠܐ ܫܩܝܠܐ ܡܘܠܕ ܠܣܘܪܛܐ ܡܓܢܛܝܣܝܐ ܒܨܘܪܬܐ ܕܚܝܠܐ ܕܚܕܐ ܥܠܬ ܙܘܓܐ ܠܗܘ ܕܚܝܠܐ ܘܣܘܪܛܐ ܐܘ ܚܝܠܐ ܘܣܘܪܛܐ ܡܓܢܛܝܣܝܐ ܕܣܡܝܐ ܡܢ ܚܕܐ ܣܘܪܬܐ ܚܕ ܡܢܘ ܠܕܘܪܢܐ ܡܚܘܝܐ ܐܝܟ ܒܨܘܪܬܐ (٨ - ١٠) ܐ, ܒ

ܐ. ܣܘܪܛܐ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ ܠܫܘܪܝܐ ܟܕ ܠܦܐ ܕܘܪܢܐ

ܒ. ܣܘܪܛܐ ܡܓܢܛܝܣܝܐ ܠܚܝܠܐ ܟܕ ܠܦܐ ܕܘܪܢܐ

ܨܘܪܬܐ (٨ - ١٠)

ܘܡܢ ܒܥܘܬܐ ܐܢܫܐ ܠܗ ܡܓܢܛܝܣܘܬܐ ܗܠܘ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܠܦܘܬ ܠܐ ܩܘܡܬܐ ܕܡܘܦܩܐ ܡܓܢܛܝܣܝܐ ܠܣܘܓܐ ܥܠ ܘܦܝܐ ܕܡܐ ܐܝܟ ܓܘ ܒܣܘܟܠܐ ܠܣܘܓܐ ܘܦܝܫ ܗܘܝܐ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܠܫܠܡܬܐ ܒܦܣܘܬܗ (ܒܦ) ܟܕ ܗܘ ܠܦܐ ܒܡܕܢܚܐ ܗܘܠܘ (ܠ) ܒܐܣܝܘܬܐ.

ܚܝܠܐ ܡܓܢܛܝܣܝܐ = ܠ ܒܦ ...... (٨ ـ ٩)

ܘܐܢ ܡܢܝܢܐ ܕܫܠܡܬܐ ܗܘܐ ܡܕܢܐ ܒܠܦܐ = ܡܢ

ܚܝܠܐ = ܡܢ ܠ ܒܦ .... (٨ ـ ١٠)

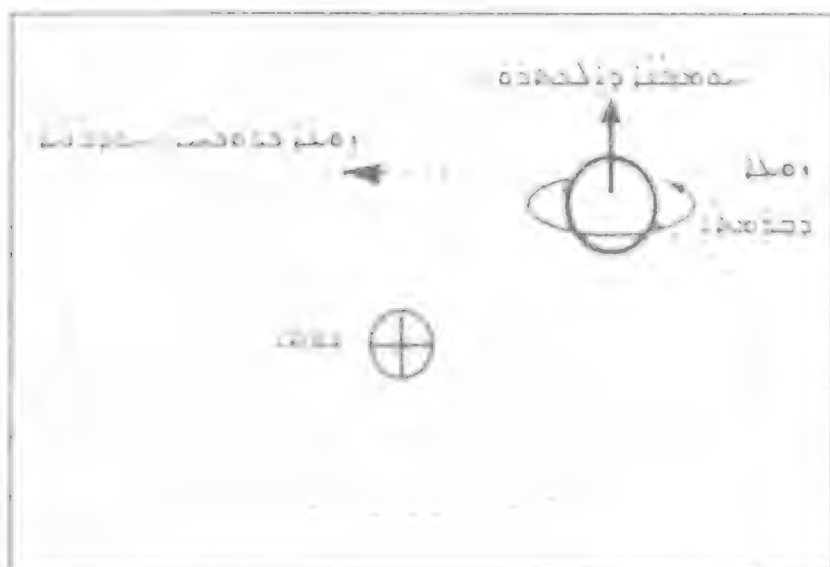
ܘܚܝܠܐ ܡܓܢܛܝܣܝܐ ܗܠܘ ܒܥܘܬܐ ܨܘܪܬܐ ܗܘܐ ܨܘܪܬܗ ܠܡܘܕܥܐ ܥܠ ܬܘܐ ܕܫܠܡܬܐ ܐܝܟ ܨܘܪܬܐ (٨ ـ ١٠ ܒ) ܘܡܢ ܐܣܝܘܬܐ (٨ ـ ١٠) ܒܗܘܝ ܚܕܘܬܐ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ (ܐܡܦܝܪ . ܡܝܬܪ ٢)

ܘܡܢ ܦܘܫܐ ܐܢܫܐ ܥܠ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܕܠܦܐ ܐܪܐ ܒܫܠܡܬܐ ܕܦܪܬܐ ܕܐܠܩܛܪܘܢܐ ܚܕ ܢܘܪܐ ܕܢܘܪܐ ܘܐܠܩܛܪܘܢ ܕܒܣܘܢܬܗ (ܒ ܘ) ܘܐܝܘܠܗܘ (ܗ) ܦܪܬܠ ܥܠ ܗܘܟܪܐ (ܦܗ) ܡܢ ܡܢܛܪܘܢ ܕܢܘܪܐ ܕܢܘܪܐ ܗܟܢ ܠܦܐ ܒܡܕܢܚܐ ܘܡܦܩܐ ܚܝܠܐ ܡܘܡܢܬܐ ܗܝܟܠܗ ܐܣܝܘܬܐ ܕܐܬܐ:

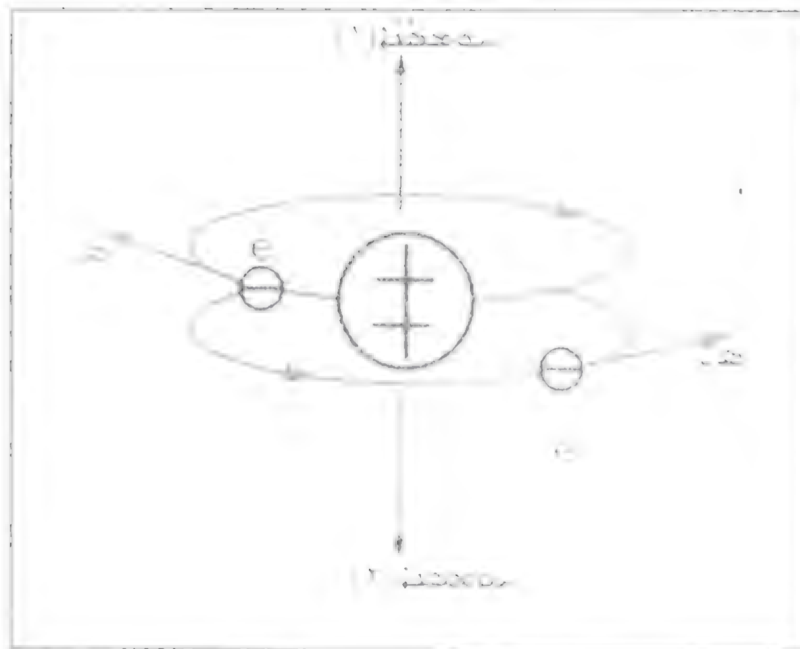
$$\text{ܚܝܠܐ ܡܘܡܢܬܐ ܕܐܠܩܛܪܘܢ} = \frac{\text{ܒ ܘ}}{\text{٢ ܦ ܦܗ}} \times \text{ܦ ܦܗ}^{٢}$$

$$\text{ܚܝܠܐ ܡܘܡܢܬܐ ܕܐܠܩܛܪܘܢ} = \frac{\text{ܒ ܘ ܦܗ}}{٢} \quad \text{........ (٨ ـ ١١)}$$

ܡܐ ܦܘܫܐ ܚܝܠܐ ܡܓܢܛܝܣܝܐ ܡܘܡܢܬܐ ܠܟܠ ܕܐܠܩܛܪܘܢ ܓܘ ܢܘܪܐ ܕܗܝܕܪܘܓܝܢ (H) ܡܛܝ ٩،٣ × ١٠ $^{-٢٤}$ ܐܡܦܝܪ . ܡܝܬܪ^{٢} ܘܐܝܬܠܗ ܒܠܝܘܬ ܠܗܡܘܙܢܐ ܡܕܥܐ ܡܢ ܐܠܩܛܪܘܢܐ ܘܦܪܘܛܘܢܐ ܘܢܘܬܪܘܢܐ ܚܝܠܐ ܡܓܢܛܝܣܝܐ



ܨܘܪܬܐ (٨ ـ ١٠ ܒ)



ܐܣܟܡܬܐ (8 - 10 ܒ)

ܙܘܕܐ ܒܟܝܠܐ ܕܦܪܟܠܘ ܣܒܪ ܢܦܩܝܘ ܦܝܫ ܡܕܢܐ ܣܘܚܦܐ ܡܓ̰ܢܛܝܣܝܐ ܢܗܐ ܝܢ (ܣܘܚܦܐ ܕܟܪܡܐ). ܘܐܣܟܡܬܐ (8 - 11) ܓ̰ܠܝܐ ܠܗ ܙܘܕܐ ܒܪܘܚܢܐ ܢܗܪܐ (ܙܘܕܐ ܕܟܪܡܐ) ܕܐܠܩܬܪܘܢ. ܡܘܚܘܐ ܠܗ ܝܚܝܢܐ ܘܦܐܪܝܬܐ ܚܕܐ ܕܣܘܚܦܐ ܡܓ̰ܢܛܝܣܝܐ ܕܝܗܒܐ ܬܚܘܬ ܟܘܠܐ ܡܬܚܙܝܐ. ܦܫܠܗ ܣܘܝܐ ܟܪܝ ܐܠܩܬܪܘܢ ܚܕ ܟܗܢܐ (ܓ̰ܘ ܟܪܘܒܐ ܚܕ ܢܘܩܐ) ܘܦܪܟܠܗ ܗܘܘ ܟܪܝ ܙܘܟܐ ܗܦܟܐ ܘܟܚܕܐ ܐܘܦܠܘܩܐ ܘܟܟܪܝ ܟܪܡܐ ܗܦܟܐ ܘܦܘܠܓ̰ܐ ܕܣܘܚܦܐ ܡܓ̰ܢܛܝܣܝܐ ܠܗ ܟܘܢ ܗܦܡܐ ܘܟܪܝ ܡܢ ܕܦܟܝ ܡܕܢܐ ܟܡܘܕܠܝܐ ܐܠܩܬܪܘܢܐ ܘܐܣܟܡܬܐ (8 - 11 ܒ) ܓ̰ܠܝܐ ܠܗ ܐܗܐ.

(8 - 10) ܬܦܘܪܘܬܐ ܡܓ̰ܢܛܝܣܝܬܐ (ܬܦ ܡܫܪܐ)

ܠܗ ܕܠܝܢܐ ܕܗܘܠܐ ܕܟܝܠܦܐ ܣܚܘܪܐ ܕܟܦܐ ܡܓ̰ܢܛܝܣܝܐ ܡܢ ܟܘܠܗ ܓ̰ܘ ܗܦܘܡܐ. ܘܐܣܟܡܬܐ (8 - 12) ܓ̰ܠܝܐ ܠܗ ܕܗܘܠܐ ܕܦܪܘܠܐ ܪܡܐ ܟܘܠܦܠܗ ܣܚܘܪܐ ܕܟܦܐ ܡܓ̰ܢܛܝܣܝܐ ܕܣܟ ܠܓ̰ܠܐ ܡܢ ܟܘܠܗ ܓ̰ܘ ܗܦܘܡܐ (ܓ̰ܘ ܦܘܫܐ).

$$ܬܦ\ ܗܦܘܡ = 4\pi \times 10^{-7}\ \frac{ܘܒܒ}{ܐܡܦܪ\ ܡܬܟ}$$

(8 - 11) ܬܦܘܪܘܬܐ ܡܓ̰ܢܛܝܣܝܬܐ ܦܫܝܛܬܐ (ܬܦ ܦܫ)

ܗܝܡܐ ܠܗ ܠܡܕܡܘܪܐ ܕܕܠܝܢܐ ܕܗܘܠܐ ܕܟܝܠܦܐ ܣܚܘܪܐ ܕܟܦܐ ܡܓ̰ܢܛܝܣܝܐ ܡܢ ܟܘܠܗ ܓ̰ܘ ܗܦܘܡܐ ܦܫܛ ܡܕܢܐ ܟܬܦܘܪܘܬܐ ܡܓ̰ܢܛܝܣܝܬܐ (ܬܦ ܡܫܪܐ). ܘܐܣܟܡܬܐ (8 - 12 ܒ . 2) ܓ̰ܠܝܐ ܠܗ ܕܗܘܠܐ ܕܦܪܘܠܐ ......
ܟܘܠܦܠܗ ܣܚܘܪܐ ܕܟܦܐ ܡܓ̰ܢܛܝܣܝܐ ܕܣܟ ܠܓ̰ܠܐ ܡܢ ܟܘܠܗ ܓ̰ܘ ܗܦܘܡܐ (ܓ̰ܘ ܦܘܫܐ).

ܗܘܠܐ ܦܪܙܠܐ

ܐܠܘܡܝܢܐ

ܨܘܪܬܐ (٨ ـ ١٢) ܣܛܘܪܐ ܕܚܝܠܐ ܡܓܢܛܝܣܝܐ ܟܪܝܟ ܡܘܬܒܐ ܡܢ ܓܘ
ܡܛܘܢܐ ܦܪܙܠܐ ܘܐܝܬܐ ܒܝܗ ܫܩ ܦܪܙܠܐ ܒܝ ܚܠܝܐ ܡܢ ܫܩ ܦܘܫܐ

$$ܫܩ_{ܡܩܘܡܐ} = ٤\,\pi \times ١٠^{-٧} \; \frac{ܘܝܒܪ}{ܐܡܦܝܪ\ ܡܝܬܪ}$$

ܚܝܠܐ ܕܫܩܠܐ ܡܓܢܛܝܣܝܐ ܕܗܘܠܐ ܠܗܘܐ ܐܝܟܐ ܕܡܝܬܐ ܘܦܢܝܐ ܡܢܝܬܐ ܦܣܝܩܬܐ ܒܝܢ ܫܩܘܒܘܠܐ ܕܗܘܠܐ ܠܫܩܘܒܘܠܐ ܕܡܩܘܡܐ ܒܫܩܘܒܘܠܐ ܦܣܝܩܬܐ ܐܝܟ ܕܐܬܐ :

$$ܫܩ_{ܦܣܝܩܬܐ} = \frac{ܫܩ_{ܗܘܠܐ}}{ܫܩ_{ܡܩܘܡܐ}}$$

(٨ ـ ١٢) ܛܘܦܣܐ ܡܓܢܛܝܣܝܐ

ܘܡܫܘܚܬܐ ܠܕܝܢܐ ܚܕܬܐ ܓܘ ܡܓܢܛܝܣܘܬܐ ܦܠܓܝܗ ܐܘܟܝܢܐ ܗܘܠܐ ܡܓܢܛܝܣܝܐ ܓܘ ܟܢܫܐ ܠܬܠܬܐ ܦܠܓܝܗ :

١ ـ ܗܘܠܐ ܕܝܡܓܢܛܝܣܝܐ
٢ ـ ܗܘܠܐ ܦܪܐܡܓܢܛܝܣܝܐ
٣ ـ ܗܘܠܐ ܦܪܘܡܓܢܛܝܣܝܐ

١ - ܦܪܡܓܢܛܝܣܘܬܐ :

ܘܐܝܢܘ ܗܘܠܐ ܕܢܬܓܪܫ ܠܘܬ ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܚܝܠܐ ܢܓܕܐ ܚܠܝܫܐ ܘܗܘ ܐܝܬ ܗܘܠܐ :

ܟܐܠܘܡ ܘܦܠܛܝܢܘܡ ܘܐܠܘܡܝܢܝܘܡ · ܘܡܓܢܝܣܝܘܡ ܘܐܟܣܓܢܐ ܘܩܪܡܐ ܘܡܠܚܐ ܘܢܘܪܐ ܘܡܝܐ ܘܢܚܫܐ ܘܦܠܕܘܡܝܢ ܘܡܟܣܝܕܐ ܘܡܢܗܘܢ ܐܝܬ ܗܘܠܐ ܕܟܕ ܚܕܐ ܡܢ ܟܘܪܝܬܐ ܐܬܚܙܝܬ ܐܬܚܘܝܬ (٨ - ١٠ ܒ). ܐܘ · ܟܕ ܐܬܬܣܝܡ ܐܝܬ ܗܘܠܐ ܠܚܩܠܐ ܡܓܢܛܝܣܝܐ ܒܪܝܐ ܚܝܠܐ ܒܒܪܐ ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܘܦܫܐ ܠܚܩܠܐ ܒܪܝܐ ܡܬܒܪܝܐ ܐܘ · ܦܠܓܘ ܟܠܝܐ ܟܐܠܐ ܟܕ ܢܚܙܐ ܡܢ ܕܐܝܟ ܗܘܠܐ ܠܘ ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܚܝܠܐ ܟܐܠܐ ܒܟܠܗ ܐܝܟܢܘܬܐ ܠܡܬܦܫܛܘ ܥܠ ܚܩܠܐ ܡܬܒܪܝܐ ܐܝܟ ܒܨܘܪܬܐ (٨ - ١٣).

ܘܦܝܫ ܡܚܝܠܐ ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܠܘ ܗܘܠܐ ܕܦܪܡܓܢܛܝܣܝܐ ܒܗܝ ܕܐܝܬ ܚܝܘܬܐ ܕܒܪܝܐ ܠܘ ܕܐܝܬ ܗܘܠܐ ܝܠܕܐ ܒܡܠܝܠ ܡܢ ܚܝܘܬܐ ܕܒܪܝܐ ܒܪܝܐ ܡܬܒܪܝܐ ܗܢܐ ܘܡܢ ܬܦܘܟܘܬܐ ܡܓܢܛܝܣܝܬܐ ܦܫܝܛܬܐ ܒܡܕܐ ܡܢ ܚܕ ܡܠܝܠ ܘܐܝܬܘܗܝ ܗܝ ܦܘܦܛܐ ܗܘܐ ܢܦ ܦܣ = ٠٫٩٩٩٨٣٤ ܒܕܪܓܐ ٢٠ ܘܐܠܝܣܝܢ ܢܦ ܦܣ = ٠٫٩٩٩٩٩٩ ܘܠܐ ܐܝܬ ܚܝܠܐ ܒܚܘܝܬܐ ܕܡܓܢܛܝܣܘܬܐ ܒܡܫܡܫܘܬܐ

ܨܘܪܬܐ ٨ - ١٣

٢ - ܗܘܠܐ ܕܝܐܡܓܢܛܝܣܝܐ

ܘܐܝܢܘ ܗܘܠܐ ܕܢܬܦܪܫ ܡܢ ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܚܝܠܐ ܢܓܕܐ ܡܚܝܠܐ ܘܡܬܚܙܝܐ ܡܢܬܐ ܡܢ ܗܘܠܐ ܐܝܟ ܢܘܪܝܢܘܢ ܦܠܕܝܢ ܘܠܘܚܝܬܐ ܐܘܩܣܒܝܢ ܒܚܝܠܐ ܘܐܢܬܦܘܟ ܘܠܐ ܢܝܩܘܢ ܘܒܬܪܗ ܘܗܘܠܐ ܒܕܝܐܡܓܢܛܝܣܝܐ ܚܝܠܐ ܢܬܦܪܫ ܐܠܗܘܬܐ ܦܪܝܫܐ ܒܚܝܘܬܐ ܕܢܦܫܗ ܒܬܪܝܢܐ ܒܗܝ ܕܐܝܬ ܗܘܐ ܠܢܦܫܗ ܚܘܫܒܐ ܡܓܢܛܝܣܝܐ ܒܗ ܗܘܦܟ ܚܕ ܢܦܫܗ ܐܝܟ ܕܒܠܝ ܡܓܢܛܝܣܐ ܘܚܙܝ ܦܝܫ ܡܢܐ ܕܢܦܠ ܐܚܪܢܝ ܘܡܠܝܐ ܐܘ · ܦܠܓܘ ܡܬܚܙܝܐ ܐܝܟ ܗܘܠܐ ܠܘ ܚܩܠܐ ܡܓܢܛܝܣܝܐ ܒܪܝܐ ܚܝܠܐ ܒܡܬܒܪܝ ܘܡܬܢܓܕܝܢ ܣܓܝܐܐ ܢܬܦܪܫ ܘܠܐ

ܗܠܝܢ ܒܠܠܬܐ ܕܡܟܒܪܢܘܬܐ ܕܫܡܫܘܬܐ ܠܗ ܗܘܠܐ (ܗܢܐ ܗܘܝ ܐܢܐ ܕܦܘܠܐ ܐܠܐ ܙܘܓܐ ܗܘܝܢܐ ܒܠܠܬܐ ܕܡܟܒܪܢܘܬܐ ܕܫܡܫܘܬܐ ܠܗ ܗܘܠܐ ܒܗܘܕ ܕܐܗܐ ܚܝܘܬܐ ܕܫܦܠܐ ܠܗ ܗܘܠܐ ܗܘܐ ܕܒ ܒܠܒܠ ܡܢ ܚܝܘܬܐ ܕܫܦܠܐ ܠܗ ܡܦܘܡܐ ܗܢܐ ܗܘܝ ܢܦܘܪܘܬܐ ܦܫܡܫܬܐ ܕܒ ܡܢ ܚܕ ܒܠܒܠ ܡܢ ܓܘܦܫܐ ܠܘܕܝܘܡ ܢܦ ܦܣ = ١,٠٠٠٠٤٠ ܗܘ. ܦܒܠܘ ܐܠܐ ܐܠܐ ܐܕܝܪܐ ܡܢ ܕܐܗܐ ܗܘܠܐ ܠܗ ܠܒܠܠܐ ܡܓܢܝܛܝܣܐ ܚܠܝܐ ܐܠܐ ܒܥܡܠ ܐܢܝܢܘܬܐ ܡܚܘܝܬܐ ܠܒܠܠܐ ܡܒܒܪܢܐ ܐܝܟ ܒܐܘܚܡܬܐ (٨ ـ ١٤) ܘܦܬܐ ܡܫܠܬܐ ܒܕܝܡܘܬܐ ܕܒܕܡܓܢܝܛܝܣܘܬܐ ܠܗ ܗܘܠܐ ܒܕܝܡܬܐ ܕܒܠܐ ܕܫܡܫܘܬܐ.

ܐܘܚܡܬܐ (٨ ـ ١٤)

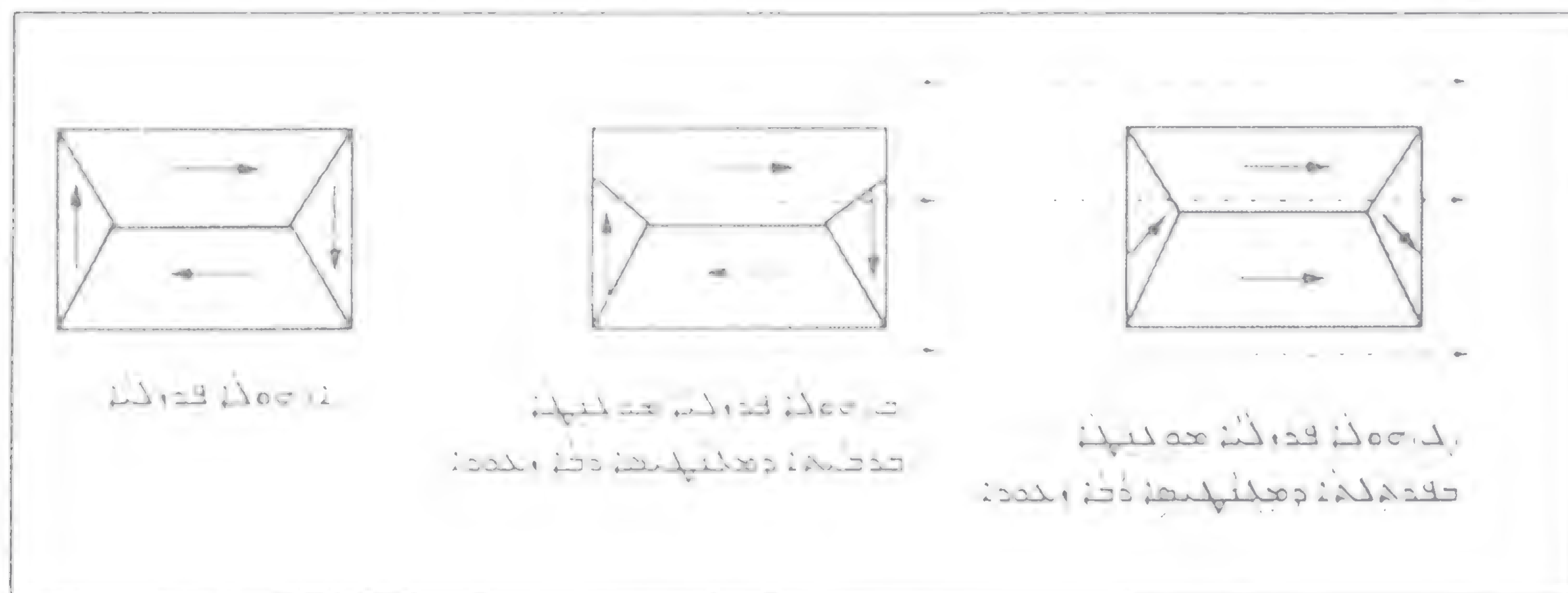
٣ ـ ܗܘܠܐ ܦܪܘܡܓܢܝܛܝܣܐ

ܘܐܝܟ ܗܘܠܐ ܕܢܦܠܘ ܡܓܢܝܛܝܣܐ ܒܪܢܐ ܢܦܩܬܐ ܐܠܗܬܐ ܗܘ. ܦܒܠܘ ܐܠܐ ܐܠܐ ܐܕܝܪܐ ܡܢ ܕܐܗܐ ܗܘܠܐ ܠܗ ܠܒܠܠܐ ܡܓܢܝܛܝܣܐ ܚܠܝܐ ܐܠܐ ܒܥܡܠ ܐܢܝܢܘܬܐ ܡܚܘܝܬܐ ܠܒܠܠܐ ܡܒܒܪܢܐ ܘܡܠܘܠܘܬܐ ܕܒ ܡܢ ܗܢܐ ܕܠܘ ܠܗ ܗܘܠܐ ܒܪܡܓܢܝܛܝܣܐ ܗܘܡ ܓܘܦܫܐ ܕܐܢܐ ܗܘܠܐ ܦܪܘܠܐ Fe ، ܟܘܒܠܛ Co ، ܢܝܟܠ Ni ، ܓܕܘܠܝܢܝܘܡ Gd ، ܕܝܣܦܪܘܣܝܘܡ Dy .

ܘܐܝܟ ܐܡܪܐ ܐܢܐ ܡܢ ܢܦܫܬܐ ܙܥܝܪܐ ܠܦܪܘܠܐ ܒܐܗܐ ܕܐܝܠܝܬܐ ܐܝܟ ܢܦܫܬܐ ܕܒܕܡܠܘ ܘܡܩܘܡܬܠ ܘܡܒܪܐ ܕܡܓܢܝܛܝܣܐ ܢܦܘܪܘܬܗ ܡܓܢܝܛܝܣܬܐ ܦܫܡܫܬܐ ܠ (٢٠٠٠٠) ܐܠܐ ܦܪܘܠܐ ܢܦܘܪܘܬܗ ܡܓܢܝܛܝܣܬܐ ܡܫܠܦܐ ܠܗ ܘܡܒܪܐ ܕܦܬܐ ܐܠܦܐ ܠܗ ܠܒܠܠܐ ܡܓܢܝܛܝܣܐ ܚܠܝܐ ܘܡܒܪܐ ܒܠܒܬܐ ܕܡܓܢܝܛܝܣܘܬܐ

ܦܪܙܠܝܐ ܠܣܘܡܟܐ (ܡܓܢܛܝܣܐ ܪܒܐ ܘܒܨܘܪܐ) ܗܪܟ ܚܠܝܦ ܡܢܝܢܗ ܡܢ ܟܢܘܫܝܐ ܕܐܬܘܡܐ ܣܘܓܐܝܗ ܟܕ ܙܘܥܐ (ܕܘܡܝܢ : Domain) ܐܡܝܢܐ ܠܗ ܗܘܝܐ.

ܡܫܠܐ ܕܦܪܙܠܝܐ ܠܐ ܡܘܠܝܐ ܗܘܐ ܠܡܓܢܛܝܣܝܗ ܪܒܐ ܘܒܨܘܪܐ ܣܘܓܐܝܗ ܡܓܢܛܝܣܐ ܒܙܘܥܐ ܐܣܘܩܐ ܘܟܒܫܘܬܐ ܕܐܬܘܡܗ. ܗܕܟܐ ܕܟܠܘܬܐ ܐܝܬܐ ܕܠܐ ܠܠܐ ܠܗ ܗܘܝܐ ܦܘܠܛܐ ܕܣܘܓܐ ܡܓܢܛܝܣܐ ܟܕ ܦܝܫ ܦܘܠܛܐ ܕܠܒܒܠܐ ܡܓܢܛܝܣܐ ܠܗ ܡܘܡܐ ܐܝܟ ܒܨܘܪܬܐ (٨ ـ ١٥ ܐ). ܐܠܐ ܦܝܫܠܗ ܟܘܠܛܐ ܠܒܒܠܐ ܡܓܢܛܝܣܐ ܟܪܐ ܚܕܡܐ ܡܢ ܐܢܐ ܡܓܢܛܝܣܐ ܪܒܐ ܘܒܨܘܪܐ ܠܟܘܢ ܟܙܘܥܐ ܕܠܒܒܠܐ ܟܡܘܬܐ ܗܟܠ ܟܠ ܟܘܪܐ ܕܐܗܐ ܠܒܒܠܐ ܟܪܐ ܗܠ ܕܡܝܢܗ ܟܠ ܐܝܢܘܬܐ ܕܡܟܬܒܐ ܠܝܟ ܠܒܒܠܐ ܠܣܘܡܐ ܐܝܟ ܒܨܘܪܬܐ (٨ ـ ١٥ ܒ).



(ܐ) ܡܫܠܐ ܦܪܙܠܝܐ ܠܐ ܡܘܠܝܐ (ܒ) ܡܫܠܐ ܦܪܙܠܝܐ ܡܘܠܝܐ ܠܣܘܡܐ ܕܡܟܬܒܐ

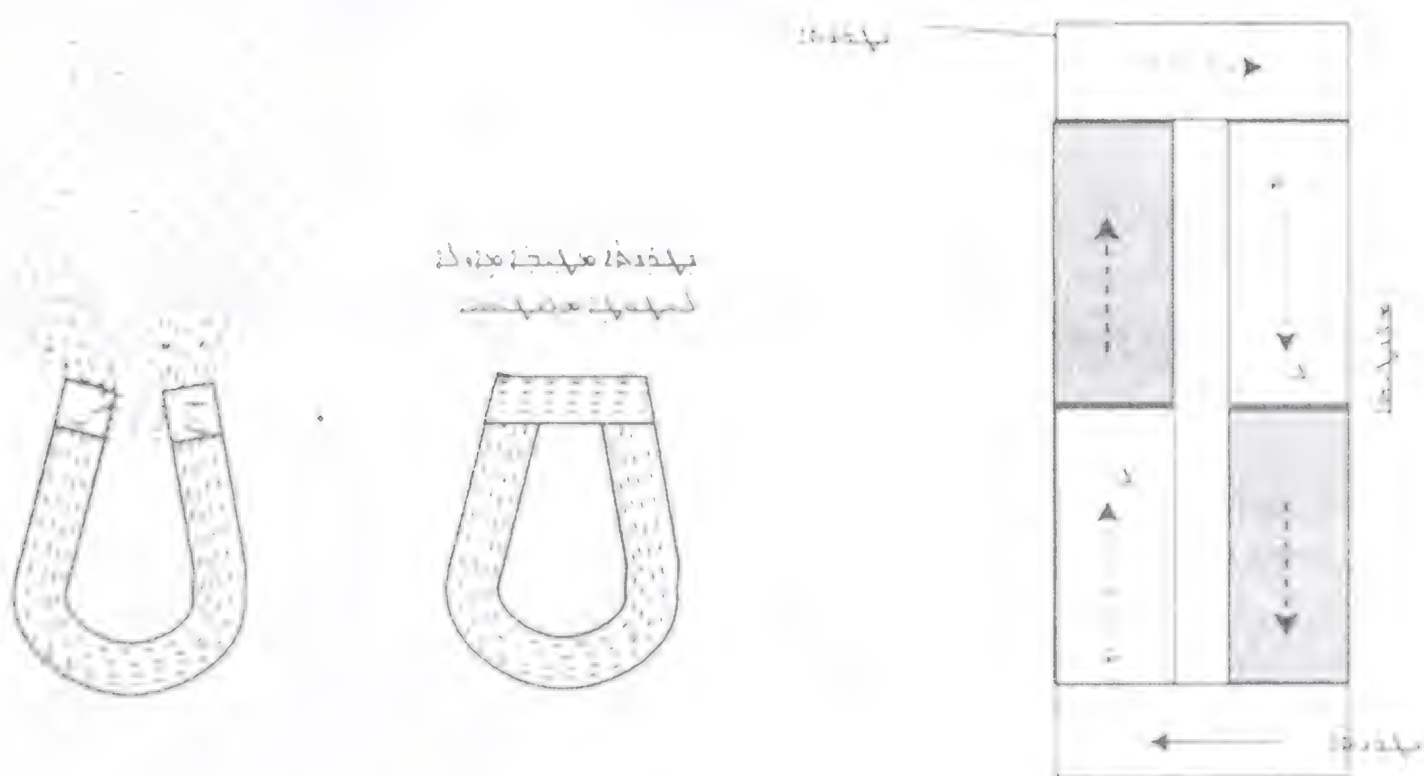
ܨܘܪܬܐ (٨ ـ ١٥)

ܘܡܘܟܢܘܬܐ ܕܡܓܢܛܝܣܐ ܟܪܐ ܠܗ ܗܘܝܐ ܦܪܙܠܝܐ ܕܒܠܝܬܐ ܠܗ ܡܟܬܒܗ ܟܒܒܠܐ ܡܘܠܝܐ ܒܝ ܟܪܟܢܬܐ ܕܡܓܢܛܝܣܐ ܪܒܐ ܘܒܨܘܪܐ ܕܒܠܝܗ ܟܙܘܥܐ ܕܠܒܒܠܐ ܟܠ ܣܘܓܐܐ ܕܡܓܢܛܝܣܐ ܐܚܪܢܐ ܐܘ ܟܦܪܘܠܬܐ ܕܚܕܡܐ ܡܓܢܛܝܣܐ ܪܒܐ ܘܒܨܘܪܐ ܘܡܦܪܫܝܗ ܟܙܘܥܐ ܕܠܒܒܠܐ ܡܓܢܛܝܣܐ ܐܝܟ ܒܨܘܪܬܐ (٨ ـ ١٦ ܐ . ܒ . ܓ).

ܨܘܪܬܐ (٨ ـ ١٦)

ܕܝܠܐ ܕܦܪܘܡܓܢܛܝܣܘܬܐ ܦܬ̈ܐ ܡܣܝܡܬܐ ܒܪܡܫܬܐ ܕܕܪ̈ܓܐ ܕܫܚܝܢܘܬܐ ܘܐܢܐ ܡܓܢܛܝܣܐ ܕܪܐ ، ܟܘܪܝ ، ܘܡܚܘܐ ܐܝܟ ܕܠܗܡܐ ܡܕܪܬܐ ܘܠܗܡܬܐ ܕܫܒܚܡܐ ܡܢܝܘ ܒܝܘܡܐ ܕܠܒܠܐ ܡܓܢܛܝܐ ܐܘ. ܦܬܠܘ ܡܘܫܚܐ ܗܘܠܐ ܦܪܘܡܓܢܛܝܣܐ ܠܕܪܓܐ ܕܫܚܝܢܘܬܐ ܡܢܫܝܐ ܒܦܝܫ ܗܘܠܐ ܡܢ ܕܝܠܐ ܒܪܡܓܢܛܝܣܘܬܐ ܘܦܝܫ ܡܕܡܐ ܒܕܪܓܐ ܕܫܚܝܢܘܬܐ ܒܕܪܓܐ ܕܫܚܝܢܘܬܐ ܕܟܘܪܝ ܘܠܝܦ ܕܪܓܐ ܕܫܚܝܢܘܬܐ ܕܟܘܪܝ ܡܢ ܗܘܠܐ ܦܪܘܡܓܢܛܝܣܐ ܠܗܘܠܐ ܐܫܪܐ ܘܕܪܓܐ ܕܫܚܝܢܘܬܐ ܕܟܘܪܝ ܠܦܪܙܠܐ ܗܝ ܠܘܦܩܐ ٧٧٠ ܗ (ܐܘ ١٠٤٣ كلفن).

ܘܦܝܫ ܡܘܦܠܫ ܗܘܠܐ ܦܪܘܡܓܢܛܝܣܐ ܒܪܒܐ ܡܢ ܠܫܡܘܫܬܐ ܠܦܘܪܘܬܝܗ ܡܓܢܛܝܣܬܐ ܦܫܝܛܬܐ ܓܠܝܬܐ ܡܢܝܗ ܩܪܝܬܐ ܕܡܓܢܛܝܣܐ ܒܕܢܚܐ ܘܐܡܝܢܐ ܘܩܪܝܬܐ ܕܢܛܪܢܬܐ ܡܓܢܛܝܣܐ ܠܢܛܪܬܐ ܕܐܘܡܢܐ ܡܢ ܡܚܒܪܢܘܬܐ ܡܓܢܛܝܣܐ ܒܪܐ ܐܝܟ ܚܠܒܐ ܘܠܢܛܪܬܐ ܕܡܓܢܛܝܣܐ ܐܡܝܢܐ ܡܢ ܒܪܢܘܬܐ ܕܡܘܒܠܬܐ ܕܡܓܢܛܝܣܘܬܗ ܒܒܒܪܬܐ ܕܐܬܢܐ ܐܝܟ ܡܘܚܘܐ ܒܨܘܪܬܐ (٨ - ١٧ ܐ , ܒ) ܘܦܝܫ ܡܘܦܠܫ ܗܘܠܐ ܦܪܘܡܓܢܛܝܣܐ ܐܝܟ ܢܘܬܐ ܕܠܒܐ ܕܣܘܪܐ.



ܨܘܪܬܐ (٨ - ١٧ܒ) ܨܘܪܬܐ (٨ - ١٧ ܐ)

(٨ ـ ١٣) ܒܬܪܝܘܬܐ ܡܓܢܛܝܣܝܬܐ (ܦܘܫܟܐ ܡܓܢܛܝܣܝܐ)

Magnetic hysteresis

ܐܝܬ ܦܘܪܫܢܐ ܒܗ ܚܕܟܡܐ ܕܝܠܝܬܐ ܡܓܢܛܝܣܝܐ ܒܝܢ ܦܪܙܠܐ ܪܟܝܟܐ (Stalloy) ܘܦܪܙܠܐ ܩܫܝܐ (Steel) ܘܡܓܢܛܝܣܝܘܬܐ ܕܟܝܐܠܗ ܦܪܙܠܐ ܪܟܝܟܐ ܒܡܫܚܠܦܘܬܐ ܝܕܝܥܬܐ ܒܓܘ ܡܘܪܕܝܐ ܒܡܫܚܠܦܐ ܕܡܫܚܠܦܢܐ ܐܠܐ ܦܪܙܠܐ ܩܫܝܐ ܢܛܪ ܥܠ ܚܕܟܡܐ ܡܢ ܡܓܢܛܝܣܝܘܬܐ ܡܢܬܐ ܒܡܫܚܠܦܢܘܬܐ ܘܐ. ܒܟܠ ܡܓܢܛܝܣܐ ܕܡܫܬܐ ܡܢ ܦܪܙܠܐ ܒܡܫܚܠܦܘ ܒܗ ܠܒܫܐ ܥܒܕ ܒܗ ܠܒܫܐ ܒܘܪܟܢܐ ܘܪܥܡܠ ܠܐܚܘܝܘܬܐ ܒܝܢ ܚܝܠܘܬܐ ܕܫܒܩܐ ܡܓܢܛܝܣܝܐ ܕܫܒܠܐ ܕܡܘܠܕܠܗ ܠܒܫܐ (ܚܝ ܗܦܘܟܐ) ܘܚܝܠܘܬܐ ܕܫܒܩܐ ܡܓܢܛܝܣܝܐ ܒܗ ܦܪܙܠܐ (ܚܝ ܗܘܠܐ) ܠܟܘܪܬܐ ܩܫܝܬܐ ܒܡܢܝܢ ܥܠ ܚܒܩܐ ܕܟܢܫܐ ܦܝܫ ܡܬܐ ܚܒܩܐ ܕܒܬܪܝܘܬܐ ܡܓܢܛܝܣܝܬܐ (ܚܠܡܐ ܕܦܘܫܟܐ ܡܓܢܛܝܣܝܐ) ܚܝ ܗܦܘܟܐ ܦܝܫ ܥܒܝܕ ܠܒܫܐ (ܠ) ܐܝܟ ܒܨܘܪܬܐ (٨ ـ ١٨).

ܨܘܪܬܐ (٨ ـ ١٨)

ܘܦܬܐ ܕܡܘܢܒܠܐ ܒܚܘܠܡܐ ܕܒܬܪܝܘܬܐ ܡܓܢܛܝܣܝܬܐ ܒܗ ܗܘܠܐ (ܦܘܫܟܐ ܡܓܢܛܝܣܝܐ) ܕܝܠܗ ܒܬܪܝܘܬܐ ܕܡܓܢܛܝܣܝܘܬܐ ܒܗ ܗܘܠܐ ܡܢ ܠܒܫܐ ܡܓܢܛܝܣܐ.

ܐܠܐ ܦܬܐ ܕܡܘܢܒܠܐ ܢܛܪܬܐ ܡܓܢܛܝܣܝܬܐ ܕܝܠܗ : ܚܝܠܘܬܐ ܕܫܒܩܐ ܡܓܢܛܝܣܝܐ ܒܗ ܗܘܠܐ ܐܝܟ ܕܝܠܗ. ܠܒܫܐ ܡܓܢܛܝܣܐ ܒܢ ܒܘܪܐ ܗܦܘܟܐ ܗܘܝܐ ܒܚܝܘܬܐ ܕܚܒܩܐ ܕܒܬܪܝܘܬܐ ܡܓܢܛܝܣܝܬܐ ܕܡܓܢܛܝܣܐ ܐܡܝܢܐ ܕܐܒܕܐ ܠܟܘܪܬܐ ܘܦܘܫܟܐ ܘܗܘܐ ܠܒܫܐ ܒܥܕܢ ܠܡܓܢܛܝܣܝܘܬܐ (ܠܒܫܐ

ܗܦܟܐ ܠܒܘܪܐ ܘܢܦܩ ܗܘܠܐ ܕܡܓܢܝܛܝܣܘܬܐ ܠܟܝܢܐ ܚܕܡܐ ܘܗܘܠܐ ܟܝܢܝܐ ܕܡܓܢܝܛܐ ܗܘܐ ܒܛܝܣܘܬܐ ܕܡܦܩܐ ܕܒܥܠܕܒܒܘܬܐ ܡܓܢܝܛܝܣܬܐ ܕܒܝܬܐ ܠܗ ܘܠܥܘܪܐ ܘܡܫܡܠܝܐ ܗܘܐ ܗܘܐ ܐܝܠܝܢ ܝܕܝܥܐ ܠܡܓܢܝܛܝܣܘܬܐ ܝܚܝܕܬܐ.

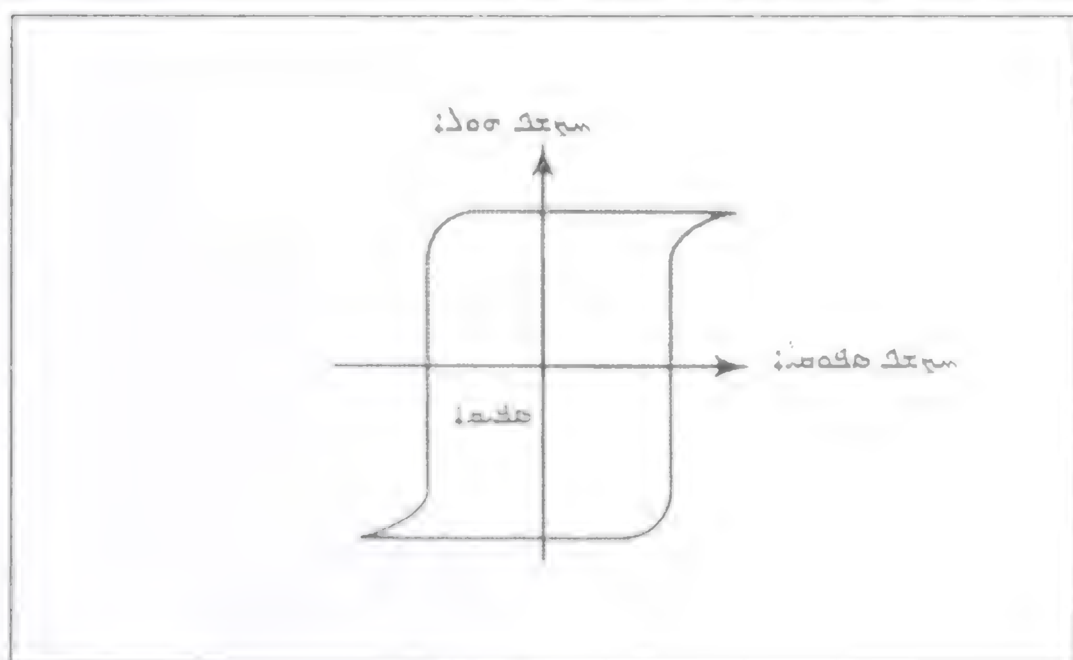
ܒܗܝ ܕܐܝܟ ܕܐܡܪܢܐ ܕܡܦܩܐ ܕܡܓܢܝܛܐ ܗܘܐ ܡܬܬܪܝܡܐ ܠܗ ܒܝܘܒܠܐ ܕܟܝܢܐ

(٨ ـ ١٠) ܦܪܙܠܝܬ (ܦܝܪܝܬ) Ferrite

ܐܝܠܝܢ ܗܘܝܢ ܦܪܙܠܝܬ ܕܡܓܢܝܛܐ ܐܠܐ ܠܐ ܐܝܠܝܢ ܚܕܬܐ ܐܠܐ ܡܬܬܪܝܡܐ ܐܝܠܝܢ ܡܢ ܗܘܠܐ ܕܡܫܚܐ ܒܚܝܦܐ ܐܝܟܠܝܢ ܟܘܪܝܐ ܐܪܥܢܝܐ ܟܠܝܐ ܙܒܢ ܠܟܘܪܝܐ ܐܪܥܢܝܐ ܕܢܦܩܐ ܒܡܠܘܐ ܠܗܘܬܐ.

ܕܝܠܗܘܢ ܡܓܢܝܛܝܣܐ ܕܐܝܬ ܗܘܠܐ ܕܒܝܕܗ ܠܟܪܣܐ ܐܠܟܬܪܘܢܝܐ ܘܒܡܘܣܝ ܒܢܘܦܘܩܗ ܡܓܢܝܛܝܣܬܐ ܦܫܝܛܬܐ ܟܠܝܬܐ ܡܛܠܐ ܚܕܡܬܐ ܐܠܦܐ ܘܡܬܝܬܐ ܒܟܡܝܬܗ ܒܗܪܝܬܐ ܡܬܝܚܐ ܒܝܢ (٥ ـ ٢٥) ܘܡܦܩܐ ܕܒܥܠܕܒܒܘܬܐ ܠܗ ܘܠܥܘܪܐ ܕܒܛܝܣܘܬܐ ܘܐܣܟܡܗ ܕܪܐ ܠܡܬܝܚܐ ܐܝܟ ܒܐܣܟܡܐ (٨ ـ ١٩).

ܘܐܗܐ ܡܬܬܪܝܡܐ ܐܝܠܗ ܒܗܝ ܒܝܒܠܐ ܡܓܢܝܛܝܐ ܗܦܟ ܒܚܕ ܙܒܢ ܠܗ ܗܦܟܬܐ ܕܝܒܠܐ ܡܓܢܝܛܐ ܒܚܕ ܕܐܗܐ ܐܝܠܗ ܡܬܬܪܝܡܐ ܠܗ ܟܢܝܬܐ ܟܠܝܐ ܒܚܕ ܕܐܗܐ ܦܫ ܡܦܩܢܐ ܦܪܝܬ ܪܒܐ ܠܗ ܙܘܢܝܬܐ ܕܡܫܬܟܚܢܝܬܐ ܒܟܝܢܐ ܕܟܢܝܬܐ ܟܠܝܐ ܘܠܗ ܡܕܝܠܝܐ ܐܠܟܬܪܘܢܝܐ ܘܐܝܟ ܡܬܡܨܝܐ ܕܢܛܪܝܢ ܕܒܝܬܐ ܒܣܓܘܝܐ ܐܠܟܬܪܘܢܝܐ (ܚܫܘܒܐ) ܐܠܐ ܗܘܝܢ ܦܪܙܠܝܬ ܕܝܠܗܘܢ (ܦܪܘܡܓܢܝܛܝܬ) ܗܘܝ ܒܝܘܪܐ ܕܡܦܠܚܬܐ ܠܗ ܟܢܝܬܐ ܟܠܝܐ ܒܟܠܗܝܢ ܕܢܛܪܘܬܐ ܕܡܓܢܝܛܝܘ ܒܟܝܢܗ ܡܢ ܕܡܬܒܥܐ ܠܐܦܠܩܐ ܠܗ ܟܘܡܦܐ.



ܐܣܟܡܐ (٨ ـ ١٩)

ܬܡܪ̈ܝܢܐ

ܫ ١ : ܓܒܝ ܠܦܬܓܡܐ ܬܪܝܨܐ ܚܕ ܡܢ ܗܠܝܢ ܕܐܬܝܢ :

١ . ܡܫܘܚܬܐ ܕܟܣܘܝܬܐ ܕܐܘܪܚܬܐ ܒܥܒܕܐ ܠܚܝܠܐ ܡܬܬܩܝܦܢܐ ܡܬܒܥܐ ܒܡܘܫܚܬܐ ܕܡܫܘܚܬܐ ܕܟܠܗ ܗܘܐ :

ܐ) ܬܪܝܨܐ ܒ) ܕܘܪ̈ܫܢܐ

ܓ) ܒܬܚܘܡܐ ܕܡܫܬܠܡܢܘܬܐ ܠܡܫܟܠܢܐ ܕ) ܐܘܦ̈ܢܐ

٢ . ܝܚܝܕܬܐ ܗܝ :

ܐ) ١٠ ^٢^ ܦܣܟܠ ܒ) $\frac{ܢܝܘܬܢ}{ܡܛ^{٢}}$

ܓ) $\frac{ܟܓܡ}{ܡܬܪ^{٢}}$ ܕ) ܟܓܡ . ܡܬܪ^٢^

٣ . ܡܘܠܐ ܕܣܝܘܡܐ ܕܥܩܪܐ ܡܬܬܩܝܦܢܐ ܠܗ ܦܫܘܛܐ ܒܡܫܘܚܬܐ ܒܟܒܐ ١٠ ܟܓ ܡܢ ܗܠܝܢ ܗܘܐ ܦܣܟܠ ܥܠ ٤٠ ܣܡ ܡܫܘܚܬܐ ܥܠܘ :

ܐ) ٠،٨ ܦܣܟܠ ܒ) ١ ܦܣܟܠ

ܓ) ٠،٥ ܦܣܟܠ ܕ) ٢ ܦܣܟܠ

٤ . ܢܦܘܩܘܬܐ ܦܫܝܛܐ ܕܗܘ ܠܐ ܦܪܘܡܬܬܩܝܦܢܐ :

ܐ) ܙܥܘܪܐ ܡܢ ܚܕ ܒ) ܫܘܝܐ ܚܕ

ܓ) ܪܒ ܡܢ ܚܕ ܕ) ܣܦܝܩܐ

٥ . ܫܘܝ ܗܪܝ ܚܝܠܐ ܡܬܬܩܝܦܢܐ ܘܕܘܪܫܐ ܐܝܟ ܕܗܘܝܐ ܥܠܘܠܘܬܐ ܕܟܣܘܝܬܐ ܕܐܘܪܚܐ .

ܐ) ܣܦܝܩܐ ܒ) ܫܘܝܐ ܠܥܠܘܠܘܬܐ ܕܐܘܪܚܐ

ܓ) ܙܥܘܪ ܡܢ ܥܠܘܠܘܬܐ ܕܐܘܪܚܐ ܒܥܠܝܐ ܕ) ܙܥܘܪ ܡܢ ܥܠܘܠܘܬܐ ܕܐܘܪܚܐ ܒܪܒܐ

ܫ٢ : ܡܠܝ ܠܦܢܝܬܐ ܕܐܬܝ ܒܡܠܬܐ ܐܘ ܦܬܓܡܐ ܬܪܝܨܐ :

١ . ܠܐ ܡܬܒܥܐ ܟܣܘܝܬܐ ܕܐܘܪܚܐ ܒܚܝܠܐ ܕܠܘܬܗ ܡܬܬܩܝܦܢܐ ܐܝܟ ܕܒܥܐ ܠܚܝܠܐ ܡܬܬܩܝܦܢܐ ܡܬܒܥܐ ܐܝܟ ܕܗܘܐ ....

٢ . ܒܪܐ ܚܝܠܐ .... ܐܝܟ ܕܪܒܝ ܗܪܝ ܠܦܐ ܕܘܪܫܐ ܒܗܪܝ ܗܠܐ ܡܬܘܢܐ.

٣ . ܐܝܠܝܢ ܗܘܠܐ ܦܪܘܡܚܫܒܢܝܬܐ ܒܡܨܥܝܘܬܗ ܕܪܟܐ ܕܡܫܡܫܢܘܬܐ
ܠܗܘܠܐ ܒܪܡܚܫܒܢܝܬܐ

٤ . ܒܡܫܘܬܐ ܕܡܫܬܡܫܢܘܬܐ ܡܚܫܒܢܝܬܐ ܐܦ ܗܘܠܐ ܡܢ ܠܫܢܐ ܡܚܫܒܢܝܐ ܦܬܐ ܡܕܝܢܬܐ ....

٥ . ܕܪܟܐ ܡܚܫܒܢܝܘܬܐ ܗܝ ܦܪܘܠܐ ܠܗܘܝܬܐ .

ܫ٣ : ܦܫ ܫܡܪܐ ܗܪܝܐ ܐܘ ܦܘܕܐ ܠܟܠ ܡܢ ܦܬܓܡܐ ܕܐܬܝܢ ܕܠܐ ܒܐܝܠܝܢܐ ܕܗܐ ܐܝܟ ܗܫܘܪܘ ܗܢܝܐ.

١ . ܦܫ ܡܕܥܐ ܚܕ ܣܝܡܐ ܡܢ ܣܝܡܘܬܐ ܕܚܠܐ ܡܚܫܒܢܝܬܐ ܒܡܕܝܢܐ

٢ . ܠܫܢܐ ܡܚܫܒܢܝܬܐ ܦܠܛ ܡܢ ܒܫܘܠܬܐ ܡܬܚܝܠܬܐ ܐܘ ܡܚܫܒܢܝܬܐ ܒܟܠܗ ܒܠܫܘܢ.

٣ . ܠܫܢܐ ܡܚܫܒܢܝܬܐ ܐܪܟܢܐ ܗܪ ܣܝܡܘܬܐ ܡܚܫܒܢܝܬܐ ܘܚܘܪ ܡܢ ܣܝܡܘܬܐ ܕܠܫܢܐ ܡܚܫܒܢܝܬܐ ܐܦ ܝܬܝܪܐ.

٤ . ܠܐ ܐܠܐ ܡܬܝܢܬܐ ܠܣܝܡܘܬܐ ܕܠܫܢܐ ܡܚܫܒܢܝܬܐ ܕܗܘܝ ܕܒܝܬܐ ܐܡܝܢܬܐ.

٥ . ܡܬܝܢܬܐ ܐܠܐ ܡܢܝܬܐ ܟܠ ܡܚܫܒܢܝܬܐ ܠܐ ܗܘܝܐ ܡܬܝܢܬܐ ܐܫܟܚܬܐ ܕܡܘܬܒܗ.

ܫ٤ : ܕܐܝܟ ܒܗܘ ܗܪܝ ܚܠܐ ܡܚܫܒܢܝܬܐ ܘܡܬܪܓܡܐ ܝܕܝܥܐ ܒܝܢ ܗܪܝ ܒܫܘܠܬܐ ܡܬܚܝܠܬܐ ܒܣܘܪܬܐ ܡܬܘܠܬܐ؟

ܫ٥ : ܒܐܡܢܐ ܚܪܝܢܘܬܐ ܦܫܬܐ ܒܡܫܡܫܬܐ ܣܝܡܘܬܐ ܕܒܦܫܐ ܡܚܫܒܢܝܬܐ ܒܛܒܥܐ ܗܟܢܐ؟

ܫ٦ : ܡܣܒܪ ܠܠܫܢܐ ܡܚܫܒܢܝܬܐ .

ܫ٧ : ܐ . ܡܢܐ ܦܫ ܡܕܥܐ ܚܕ ܣܝܡܐ ܡܢ ܣܝܡܘܬܐ ܕܚܠܐ ܡܚܫܒܢܝܬܐ؟
ܒ . ܒܗܘܒ ܠܐܣܝܡܘܬܐ ܡܬܝܢܬܐ ܒܝܢ ܡܫܡܫܢܐ ܘܚܕ ܘܡܕܥ .

ܫ٨ : ܟܠ ܡܢܐ ܐܝܟ ܚܠܐ ܕܠܗܕܝܢ ܒܪܢܫܐ ܒܝܢ ܒܫܘܠܬܐ ܡܬܚܝܠܬܐ؟

ܫ٩ : ܡܢܐ ܝܠܗ ܐܣܟܡܐ ܕܡܐܙܠܬܐ ܕܟܕܪܐ ܒܗ ܦܪܘܦܐ، ܘܐܝܟ ܡܢ ܓܘ ܚܝܠܬܐ ܡܓܢܛܝܣܝܐ ܡܚܒܫܐ ܠܐܝܒܘܬܐ ܕܐܟܝ :
١ . ܒܙܘܕܐ ܐܢܬܘܕܝܬܐ ܥܠ ܚܝܠܬܐ.
٢ . ܐܝܟ ܘܝܬܐ ܠܐ ܗܘܝܐ ܘܡܝܦܬܐ ܥܡ ܚܝܠܬܐ . (ܦܝܫ ܠܐ ܗܘܐ).

ܫ١٠ : ܡܢܐ ܝܠܗ ܕܡܘܠܕ ܕܚܝܠܬܐ ܡܓܢܛܝܣܝܐ ܠܝܢܝܐ؟ ܦܝܫ ܠܐ ܗܘܐ.

ܫ١١ : ܡܢܐ ܝܠܗ ܢܝܢܐ ܒܡܘܙܘܓܢܐ ܐܠܩܛܪܘܢܐ؟ ܦܝܫ ܠܐ ܗܘܐ.

ܫ١٢ : ܡܢܐ ܝܠܗ ܦܘܪܫܢܐ ܒܝܢ ܐܘܡܐ ܕܐܝܕܐ ܝܡܝܢܐ ܠܡܝܚܕܐ ܕܙܘܥܐ ܕܚܝܠܐ ܕܠܘܒܘ ܘܐܘܡܐ ܕܐܝܕܐ ܝܡܝܢܐ (ܣܡ) ܕܠܒܦܐ ܘܐܘܡܐ ܕܚܝܠܬܐ ܠܡܝܚܕܐ (ܣܡ) ܓܘ ܟܐܠܐ؟

ܫ١٣ : ܥܠ ܡܢܐ ܟܠܬܐ ܚܝܘܬܐ ܕܢܦܩܐ ܡܓܢܛܝܣܝܐ ܓܘ ܠܒܦܐ ܐܘܦܪܫܐ ܢܕܝܕܐ ܠܟܗ ܦܘܫܐ؟

ܫ١٤ : ܥܠ ܡܢܐ ܟܝܠ ܚܝܠܐ ܕܢܦܩܐ ܐܘ ܢܦܩܬܐ ܡܟܚܝܠܦܬܐ ܒܝܢ ܟܕܝ ܟܐܠܐ ܡܒܘܪܝܐ ܓܢܝܐ ܘܠܚܕ ܡܢܝܗ ܠܦܐ ܒܘܪܟܐ ܦܝܫ ܕܐܝܬ ܗܘܐ ܐܗܐ ܚܝܠܐ؟
١ . ܢܦܩܬܐ   ٢ . ܢܦܩܬܐ

ܫ١٥ : ܥܠ ܡܢܐ ܟܠܬܐ ܚܝܘܬܐ ܕܢܦܩܐ ܡܓܢܛܝܣܝܐ ܓܘ ܢܘܡܙܬܐ ܒܦܘܫܐ ܚܕ ܡܟܚܝܢܐ ܟܕܝܐ ܓܢܝܐ ܠܦܐ ܒܘܪܟܐ؟

ܫ١٦ : ܥܠ ܡܢܐ ܟܝܠ ܒܘܢܝܐ ܕܣܘܡܢܐ ܡܓܢܛܝܣܝܐ ܠܣܠܘܩܐ ܐܟܕ ܒܗ ܠܦܐ ܒܘܪܟܐ؟

ܫ١٧ : ܐܢ ܦܝܫܠܗ ܓܠܝܬܐ ܟܡܐ ܕܒܘܡܐ ܕܢܟܠܐ ܡܓܢܛܝܣܝܬܐ ܡܢ ܐܡܐ ܗܘܠܐ ܝܠܗ ܟܡܝܫ؟ ܘܠܡܐ؟

ܫ١٨ : ܒܡܐ ܐܡܝܗ ܟܦܦܐ ܕܒܟܐܕܝܬܐ ܡܓܢܛܝܣܝܬܐ ܠܗܘܠܐ ܟܦܠܚܐ ܓܘ ܙܒܘܢܬܐ ܕܡܓܢܛܝܣ ܐܡܝܢܐ ܕܓܒܘܬܐ . ܘܠܡܐ؟

ܫ١٩ : ܒܐܝܢ ܗܟܙܐ ܗܠܠܐ ܢܬܒܪ ܒܗ ܠܦܐ ܒܗܪ̈ܬܐ ܐܠܐ ܠܚܕܠܗ ܡܟܟܕܢܘܬܐ ܡܫܬܘܫܛܢܘܬܐ ؟

ܫ٢٠ : ܥܠ ܡܢ ܡܣܘܬܐ ܗܘܢܐ ܕܠܒܠܐ ܡܫܬܘܫܛܢܘ̈ܬܐ ܣܓܝ ܗܠܝܢ ܡܫܬܘܫܛܢܐ ܡܢ ܢܫܬܐ ؟

ܫ٢١ : ܐܝܟ ܗܘܐ ܡܬܝܕܥܐ ܕܥܣܘܢܬܐ ܕܕܘܟܬܐ ܘܐܝܟ ܗܘܐ ܐܘܦܩܬܐ ؟ ܠܠܐ ܠܗܘܐ ܒܗܘܢܡܐ .

ܫ٢٢ : ܡܢ ܡܢܝܢ ܠܗܘܠܐ :

١ . ܐ . ܣܥܘܠܝܗ ܢܗܘܐ ܥܠ ܐܠܗܕܘܢܐ ܦܪܝܫܐ ܒܣܒܘܡܐ ܒܡܢܗ ܘܦܫܠܝܗ ܢܗܘܐ ܕܡܦܘܠܐ ܒܡܠܟ ܙܘܓܐ ܣܘܡܝܐ .

٢ . ܒ . ܣܥܘܠܝܗ ܥܠ ܡܫܬܘܫܛܢܐ ܕܟܐ ܘܚܘܕܐ (Domains) ؟

٣ . ܓ . ܢܗܘܝܗ ܗܘܝ ܡܗܘܕܥܐ ܡܢ ܡܘܕܘܥܐ ܐܠܗܕܘܢܐ ؟

ܫ٢٣ : ܗܕܐ ܒܡܐ ܣܓ ܡܢܝܗ ܡܗܘܕܥܐ ܡܢ ܗܘܠܐ ܕܡܫܬܘܫܛܢܐ ܘܐܣܕܢܐ ܡܢ ܗܘܠܐ ܒܕܡܫܬܘܫܛܢܐ ܦܕܘܒ ܒܢܗܝܗ ܒܡܦܠܣܬܐ ܕܠܒܠܐ ܡܫܬܘܫܛܢܐ ܣܠܝܢܐ ܠܣܡܢܐ ؟

ܫ٢٤ : ܡܢ ܝܠܗ ܡܟܟܕܢܘܬܐ ܕܕܢܡܬܐ ܕܕܪܓܐ ܕܡܫܡܫܘܬܐ ܒܕܝܠܬܐ :

١ . ܕܡܫܬܘܫܛܢܘܬܐ ٢ . ܬܪܡܫܬܘܫܛܢܘܬܐ ٣ . ܩܕܡܡܫܬܘܫܛܢܘܬܐ

ܫ٢٥ : ܒܢܡܬܐ ܐܢܒܢܘܬܐ ܡܛܠܠܗ ܗܘܠܐ ܩܕܡܡܫܬܘܫܛܢܐ ܕܝܠܗ ܡܫܬܘܫܛܢܐ ܣܠܝܢܐ ؟

ܫ٢٦ : ܡܢ ܒܪܐ ܐ . ܦܥܠܐ ܡܘܝܕܥܐ ܢܦܘܕܘܬܐ ܡܫܬܘܫܛܢܘܬܐ ܦܣܩܬܐ ܠܡܝܬܐ ܒܝܢ ܗܕܐ ܗܠܝܢ ܗܝܒܘܢܐ ܦܠܚܝ ܠܦܐ ܒܗܪ̈ܬܐ ؟

ܫ٢٧ : ܠܡܢܐ ܠܐ ܗܘܐ ܠܒܠܐ ܡܫܬܘܫܛܢܐ ܐܪܥܐ ܐܚܘܬܐ ܣܓܝ ܡܕܢܐ ؟

ܫ٢٨ : ܡܢ ܝܠܗ ܦܘܪ̈ܫܢܐ ܒܝܢ ܗܘܠܐ ܩܕܡܡܫܬܘܫܛܢܐ ܘܦܪܡܝܗ ؟

ܫ٢٩ : ܡܰܢܘ ܩܰܕܡܳܝܳܐ ܗܘܳܐ ܡܶܢ ܡܰܟܬܒ̈ܳܢܶܐ ܕܣܘܪܝܝܘܬܐ ܡܬܰܪܓܡܳܢܽܘܬܳܐ؟

ܫ٣٠ : ܠܡܢܐ ܩܪܝ ܚܪܝ̈ܢܐ ܗܘܢܝܐ ܡܬܰܪܓܡܳܢ̈ܶܐ ܐܢܫ̈ܐ ܕܡܬܰܪܓܡܳܢܽܘܬܳܐ؟

ܫ٣١ : ܐܡܪ ܐܪ̈ܒܥܐ ܡܢ ܗܘܠܐ ܩܪܝ ܡܫܠܡܢܐ ܠܗ :

١ . ܢܘܗܪܐ ܕܡܕܢ̈ܚܐ؟

٢ . ܡܬܚܠܦܢܘܬܐ؟

٣ . ܡܬܰܪܓܡܳܢܐ ܕܟܠܗ ܢܘܡܘܣܐ؟

٤ . ܚܕܝܘܬܐ ܕܡܬܪܓܡܢܐ ܠܗ ܚܢܘܟܝܐ ܠܟܬܒܘ̈ܢܐ؟

ܕܘܪ̈ܫܐ

ܫ١ : ܐܝܟܢ ܚܘܝܠܐ ܕܫܪܝܘܬܐ ܕܟܦܘܦܐ ܡܓܢܛܝܣܝܬܐ ܠܗ ܢܘܩܙܬܐ ܕܡܨܥܬܐ ܕܚܘܕܪܐ ٥ ܣܡ ܡܢ ܕܐܠܐ ܛܠܝ ܠܦܪ ܚܘܝܠܐ (٢٥ ܡܠܝ ܐܡܦܝܪ)؟

ܦ : ١٠ × π⁻⁷ ܛܣܠܐ ܚܕ ܠܘܩ

ܫ٢ : ܟܡܐ ܗܘܐ ܚܘܝܠܐ ܕܠܦܐ ܟܪܟܐ ܕܠܦܐ ܕܣܠܝܢܘܝܕ ܐܝܟ ܦܘܫܐ ܡܢܝܢܐ ܕܠܦܐ ٢٥٠ ܠܦܐ ܘܐܘܪܟܗ ٢٥ ܣܡ ܠܡܗܘܐ ܟܠ ܫܪܝܘܬܐ ܕܟܦܘܦܐ ܡܓܢܛܝܣܝܬܐ ٦٢.٨ × ١٠⁻⁴ ܛܣܠܐ ܠܗ ܠܦܐ ܠܓܘ ܡܨܥܬܗ؟

ܦ : ٥ ܐܡܦܝܪ

ܫ٣ : ܟܡܐ ܗܘܐ ܚܘܝܠܐ ܕܫܪܝܘܬܐ ܕܟܦܘܦܐ ܡܓܢܛܝܣܝܬܐ ܒܡܨܥܬܐ ܕܠܦܐ ܟܪܘܟܬܐ (٢ ܐ) ܘܡܢܝܢܐ ܗܘܐ ܡܢ ܢܟܘܪܘܬܐ ܡܓܢܛܝܣܝܬܐ ܦܫܝܛܬܐ ܟܘܠܗ ١٠٠؟

ܦ : ٠،٦٢٨ ܛܣܠܐ

ܫ٤ : ܫܟܚ ܣܘܦܩܐ ܡܓܢܛܝܣܝܐ ܕܠܦܐ ܡܕܒܪܐ ܕܠܦܐ ܐܚܪ ܡܢ ٢٠ ܠܦܐ ܬܚܘܡܬܐ ܕܚܕ ܠܦܐ ١٠ ܣܡ² ܘܡܥܒܪ ܒܗ ܠܦܐ ܚܘܝܠܐ (٢ ܡܠܝ ܐܡܦܝܪ)

ܦ : ٠،٠٠٤ ܐܡܦܝܪ. ܡܛܪܐ²

ܫ٥ : ܟܡܐ ܗܘܐ ܚܘܝܠܐ ܕܣܘܦܩܐ ܟܪܘܟܝܐ ܕܐܠܩܛܪܘܢ. ܦܪܝܫ ܚܕ ܢܘܗܪܐ ܕܡܛܪܐ ܐ. ܐܠܩܛܪܘܢ ٢.٣ × ١٠⁻⁶ ܡܛܪܐ ܕܦܐܝ ܘܦܠܓܐ ܕܩܛܪܐ ܕܟܪܘܟܝܐ ܚܕ ܢܘܗܪܐ ٥ × ١٠⁻¹¹ ܡܛܪܐ؟

ܦ : ٨،٨ × ١٠⁻²٤ ܐܡܦܝܪ. ܡܛܪܐ²

ܫ٦ : ܡܕܡ ܡܐܠܐ ܢܕܒܟ ܡܟܘܢܢ ܒܡܠܬܐ ܟܢܫܐ ١،٠٠ ܡܛܪܐ ܦܪܝܣ ܟܢܫܐ ܦܘܫܐ ܘܛܠܝܢ ܚܕ ܡܢܝܢܐ ܠܦܐ (١ ܣܡ) ܘܐܚܪܢܐ (٢ ܣܡ) ܐܝܟ ܟܚܕ ܙܘܓܐ ܫܟܚܝܢ ܚܝܠܐ ܡܢ ܚܠܦܐ ܟܢܫܐ ܠܟܠ ܡܛܪܐ ܡܢܝܢܐ.

ܦ : ٤ × ١٠⁻⁶ ܢܝܘܛܢ ܢܟܦܐ

ܦܣܘܩܐ ܬܫܝܥܝܐ ܐܠܩܛܪ̈ܘܢܝܐ

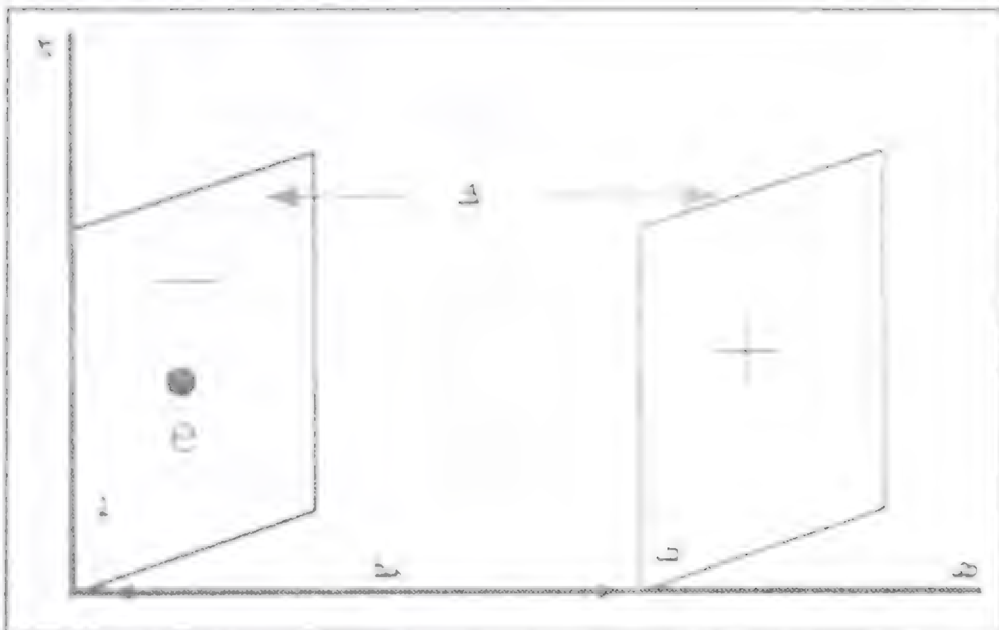
Electronics

ܒܢܝܫܐ ܠܘܩܒܠ ܗܢܐ ܦܣܘܩܐ ܢܬܠ ܐܪܥܐ ܡܢ ܗܘܦܟܐ ܐܠܩܛܪܘܢܝܐ ܥܠܘܗܝ ܙܘܥܐ ܪܘܚܢܝܐ ܘܕܝܠܢܝܐ ܘܦܘܠܚܢܝܐ ܘܚܫܘܒܢܝܐ. ܗܘܝ ܕܗܢܐ ܦܠܐ ܝܬܝܪܐ ܒܡܕܥܐ ܥܠ ܡܦܪܢܣܘܬܐ ܕܚܝܠܐ ܒܘܪܟܐ ܥܠ ܙܘܥܐ ܕܐܠܩܛܪܘܢܐ ܒܦܪܢܣܐ ܠܘܬ ܘܢܚܫܘܒܬܐ ܕܫܟܝܚܬܐ ܥܠ ܦܠܛܬܐ ܐܠܩܛܪܘܢܝܬܐ ܣܟܡܘܬܢܝܬܐ ܘܡܘܪܢܝܬܐ.

(٩ - ١) ܙܘܥܐ ܕܐܠܩܛܪܘܢ ܓܘ ܚܩܠܐ ܟܗܪܒܝܐ

ܒܪܡ ܚܕܝܚ ܗܘܝܐ ܕܟܪܝ ܙܦܫܐ ܟܡܝܐ ܡܟܘܢܐ ܘܡܦܬܐ ܘܪܘܚܐ . ܒ ܡܘܟܢܐ ܓܘ ܡܦܘܩܐ ܘܟܘܠܟܐ ܟܢܠܐ ܚܘܐ ܒ ܘܦܘܪܫܢܐ ܕܟܘܫܢܐ ܟܢܠܐ ܦ ܒܗܠܝܛ ܟܘܐ ܟܘܪܐ ܕܚܩܠܐ ܟܗܪܒܝܐ ܡܫܟܚܐ ܟܢܠܐ

$$\text{ܫܛ} = \frac{\text{ܦ}}{\text{ܡ}} \quad \text{ܒܗܠܝܛ ܡܟܕ}$$



ܨܘܪܬܐ (٩ - ١)

ܐܠܩܛܪܘܢܐ ܢܦܠܐ ܓܘ ܙܦܫܐ ܐܠܗܘܬܐ ܐܝܟܢܐ (٩ - ١) ܒܢܠܦ ܟܝܘܪܐ ܕܙܦܫܐ ܦܘܫܟܐ ܒ.

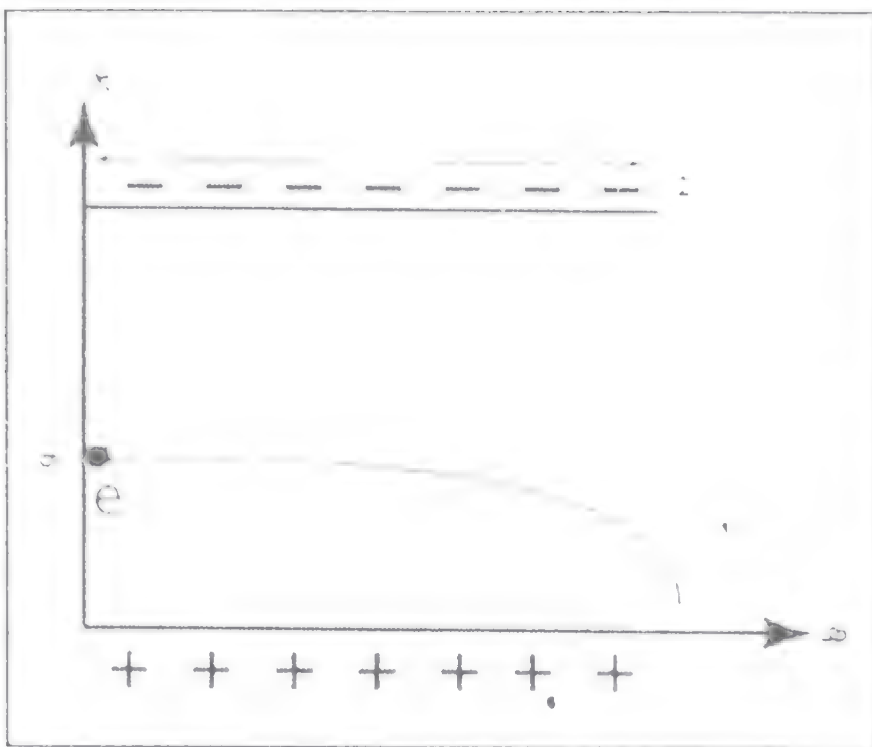
ܘܐܝ ܗܘܐ ܚܐܪܐ ܕܝܘܪܐ ܒܦܪܘܒ ܙܘܒ ܙܦܫܐ ܒ ܟܝܘܪܐ ܕܦܪܢܐ ܡܫܟܚܢܐ.

ܘܟܕ ܐܠܩܛܪܘܢ ܝܠܗ ܢܦܠܐ ܓܘ ܚܩܠܐ ܟܗܪܒܝܐ ܟܘܕ ܕܐܗܐ ܡܟܕܕ ܝܠܗ ܚܝܠܐ ܟܘܢܠܗ ܚ = ܫܛ × ܬ ܟܕ ܬ ܝܠܗ ܬܚܘܡܐ ܕܐܠܩܛܪܘܢ. ܒܟܘܠܗ ܐܦ ܚ = ܓ ܗ ܟܕ ܗ ܝܠܗ ܡܪܘܒܝܐ ܕܐܠܩܛܪܘܢ. ܟܝܘܪܐ ܕܦܪܢܐ ܡܫܟܚܢܐ. ܓ ܟܘܡܠܐ ܕܐܠܩܛܪܘܢ ܒܟܝܠܘܓܪܡ.

$$\text{ܓ ܗ} = \text{ܫܛ} \times \text{ܬ} \longrightarrow \text{ܛ} = \frac{\text{ܬ}}{\text{ܓ}} \times \text{ܫܛ}$$

$$\text{ܐܘ ܛ} = \frac{\text{ܬ}}{\text{ܓ}} \times \frac{\text{ܒ}}{\text{ܡ}} \quad \text{... (٩ - ١) ܘܦܝܫܐ ܟܝܠܐ ܒܣܪܘܥܘܬܐ ܡ \ ܪܦ ٢}$$

ܐܢܐ ܐܝ، ܘܡܟܐ ܐܝܗܘܐ ܙܡܘܪܢܐ ܥܠ ܙܘܥܐ ܕܚܩܠܐ ܟܗܪܒܝܐ (ܨܘܪܬܐ ٩ - ٢) ܘܡܟܐ ܕܐܠܩܛܪܘܢ ܓܘ ܚܩܠܐ ܟܗܪܒܝܐ ܕܡܐ ܘܡܟܐ ܕܡܪܘܡܝܬܐ ܓܘ ܚܩܠܐ ܕܢܦܪܢܐ ܡܫܟܚܐ.



ܨܘܪܬܐ (٩ - ٢)

ܘܐܝܟ݂ ܕܦܝܫ ܡܚܘܝܐ ܐܠܟܬܪܘܢ ܡܢ ܢܩܘܕܬܐ ܗ ܠܗ ܡܦܘܩܝܐ ܒܝܡ ܓܪܘܫܐ ܙܩܝܦܬܐ ܡܒܘܥܝܐ . ܒ ܒܝܬܐ ܠܚܝܠܐ ܕܘܪܟܐ ܡܫܟܚܐ ܒܗܘܝܐ ܒܗ ܕܪܘܟܐ ܕܫܕܝܐ ܙܪܝܐ ܘܡܟܐ ܕܐܠܟܬܪܘܢ ܒܝܡ ܓܪܘܫܐ ܙܩܝܦܬܐ ܡܢ ܫܘܪܒܐ ܘܡܦܩܐ ܠܗ ܠܣܦܪ. ܐܠܐ ܠܗ ܚܝܠܐ ܡܟܒܟ ܥܠܗ ܕܪܘܟܐ ܕܫܕܝܐ ܫܡܝܟܬܐ ܒܗܕ ܕܐܗܐ ܡܠܘܠܘܬܐ ܕܐܠܟܬܪܘܢ.

ܦܬܐ ܡܟܝܢܬܐ ܒܐܗܐ ܙܘܒܐ ܡܫܘܚܬܐ ܕܡܫܟܠܗ ܐܠܟܬܪܘܢ. ܒܪܘܟܐ ܕܫܕܝܐ ܫܡܝܟܬܐ ܡܘ = ܡ ، ܘܟܕ ܡܠܘܠܘܬܐ ܕܐܠܟܬܪܘܢ. ܒܪܘܝܬܐ ܒܪܘܟܐ ܕܫܕܝܐ ܙܪܝܐ ܒܘܢܐ ܡܦܩܐ ܡܠܘܠܘܬܐ ܘܡܫܘܚܬܐ ܥܠ ܫܕܝܐ ܙܪܝܐ ܟܪܟ ܘܒܢܐ ، ܦܬܐ ܣܘܟܝܢܬܐ ܐܝܟ ܐܫܘܬܐ :

ܡ ٢ = ٠ + ܠ ܘ   ܗ = ܠ ܘ

ܗܘ = ٠ + ١/٢ ܠ ܘ ٢ ،   = ١/٢ ܠ ܘ ٢

ܐܝܟܐ ܠ = ܗ/ܟ × ܦ/ܡ

ܒܗܕ ܕܐܗܐ ܘܡܟܐ ܕܐܠܟܬܪܘܢ. ܗܘܐ ܒܡܠܘܠܘܬܐ ܠܗ ܦܘܠܛܐ ܕܟܕ ܡܠܘܠܘܬܐ ܫܪܐ ܡܝܢܗ ܡܒܘܥܬܐ ܠܚܝܠܐ ܕܘܪܟܐ ܒܡܦܪܘܟܐ ܡܫܟܚܐ ܘܐܫܪܝܬܐ ܒܡܘܒܕܬܐ ܥܠ ܙܘܟܐ ܕܚܝܠܐ.

٩ - ٢) ܦܠܛܬܐ ܕܐܠܟܬܪܘܢ̈ܐ ܒܡܟܒܪܢܘܬܐ ܕܣܡܝܡܘܬܐ

ܐܝܟ ܕܐܡܝܪܘ. ܚܒܪܐ ܗܘܐ ܢܦܩܐ ܥܠ ܠܒܘܫܐ ܒܟܕܒܘ. ܠܗܝܠ ܠܗ ܐܒܘܟܐ ܡܫܘܦܩܐ ܡܢ ܦܘܫܐ ܠܟܒܪܬܐ ܕܝܠܗ ܕܘܪܟܐ ܘܐܗܐ ܒܫܢܬܐ ١٨٨٣ ܡ

ܡܘܒܛܠܘ ܙܦܣܗܐ ܣܦܩܬܐ ܠܗ ܐܟܘܦܐ ܡܫܘܦܐ ܥܠ ܓܕܘܢܐ ܘܡܘܥܒܠܘ ܠܗ ܡܥܣܝܬܐ ܕܓܕܘܢܐ ܐܝܟ ܥܢܒܐ ܘܐܫܪܬܐ ܕܙܦܣܗܐ ܒܓܠܒܢܘܡܝܛܪ ܠܡܘܚܛܐ ܗܘܡܐ ܠܡܚܘܬܐ ܕܠܦܐ ܐܡܝܢܐ ܒܦܠܓ ܓܠܒܢܘܡܝܛܪ ܡܘܚܘܝܐ ܚܒܪܬܐ ܕܠܦܐ (ܨܘܪܬܐ ٩ - ٣) ܐܠܐ ܠܐ ܥܒܪ ܠܦܐ ܐܝܡܡ ܕܦܬܐ ܐܫܝܪܬܐ ܙܦܣܗܐ ܠܡܘܚܛܐ ܓܠܘܙܐ. ܦܘܪܫܐ ܕܒܕܝܩܘܬܐ ܕܐܕܝܣܘܢ ܥܠܗ ܕܐܠܩܛܪܘܢܐ ܦܠܛܬܐ ܡܢ ܓܕܘܢܐ ܚܡܝܡܐ ܢܗܦܟ ܙܘܥ ܙܦܣܗܐ ܐܝܡܡ ܕܗܘܐ ܙܦܣܗܐ ܫܘܡܬܐ ܕܚܘܝܬܐ ܐܠܐ ܢܦܪܫ ܥܡܢܘܬ ܐܝܡܡ ܕܗܘܐ ܓܠܘܙܐ ܕܚܘܝܬܐ.

ܨܘܪܬܐ (٩ - ٣) ܢܣܝܢܐ ܕܐܕܝܣܘܢ

ܦܠܛܬܐ ܕܐܠܩܛܪܘܢܐ ܡܢ ܥܛܫܐ ܕܣܦܩܐ ܬܗܕ ܡܢܗܘܢ ܗܘܦܟܐ ܘܪܚܒܐ ܟܡܥܢܝܬܐ ܚܒܕܠܘ ܡܘܢܢܐ ܡܢ ܥܕܬܐ ܕܐܫܪܬܐ ܘܦܠܛܬܗ ܡܢ ܥܛܫܐ. ܦܪܬܐ ܡܕܬܐ ܐܗܐ ܟܕܝܩܘܬܐ ܟܦܠܛܬܐ ܐܠܩܛܪܘܢܝܬܐ ܕܫܡܫܘܬܐ. ܘܥܛܫܐ ܡܦܠܛܢܐ ܠܐܠܩܛܪܘܢܐ ܦܪ ܡܕܢܐ ܡܥܢܝܬܐ (ܟܬܘܕ) ܘܥܛܫܐ ܡܩܒܠܢܐ ܠܗ ܦܪ ܡܕܢܐ ܡܫܡܠܝܐ (ܐܢܘܕ).

ܘܐܝܬ ܗܡܐ ܡܢܝܢܐ ܡܢ ܨܘܪܬܐ ܕܡܥܢܝܬܐ ܡܘܢܝܬܐ ܥܠܗ ܐܦܩܬܗ ܠܦܘܬ ܐܘܪܚܐ ܕܡܥܢܝܬܗ ܡܢܗ ܗܕܐ ܐܦܝܐ :

١ . ܡܢܝܢܐ ܡܘܥܢܝܐ ܡܥܢܝܬܐ ܐܚܝܬܐ ܦܪ ܡܕܢܐ ܒܥܢܝܢܐ ܠܓܕܘܢܐ ܘܦܪ ܡܫܘܠܛܐ ܠܐܦܝܐ ܠܦܘܬ ܗܘܠܗ .

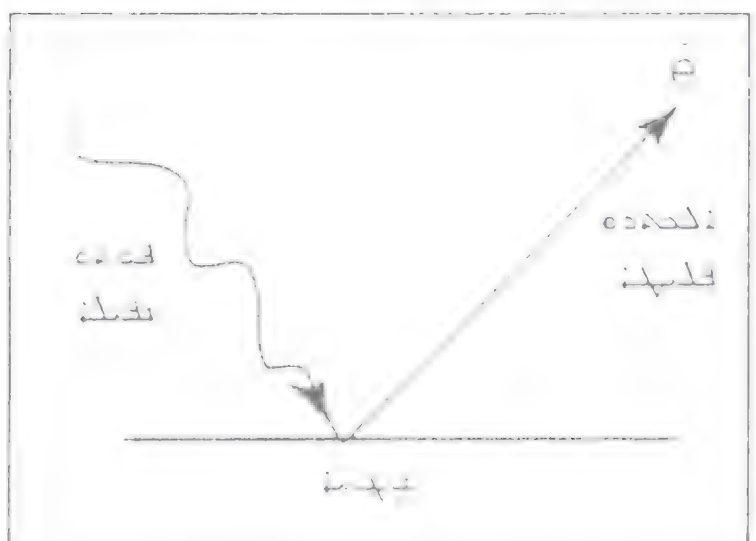
٢ . ܓܕܘܢܐ ܕܡܢܚܬܐ ܦܪ ܡܟܘܪܙܐ ܡܢ ܣܦܩܐ ܕܡܢܚܬܐ. ܙܦܢܐ ܒܗܘ ܠܫܡܐ ܥܠܗ ܠܦܠܛܬܐ ܕܫܡܫܘܬܐ ܒܗܘ ܕܪܓܐ ܕܦܬܪܬܗ ܥܠܬܐ ܥܠܗ ܕܪܐ ܘܐܠܐ ܢܣܒܐ ܡܢܗ ܡܘܢܝܬܐ ܥܠܗ ܡܥܢܝܬܗ ܒܚܝܢܐ ܥܠ ܕܪܓܐ ٢٥٠٠ ܒܠܚܡ

ܒ. ܓܘܒܐ ܕܓܙܐ. ܡܬܬܘܡܝܐ ܒܐܘܪܚܐ ܕܝܠܗ: ܓܙܐ. ܡܬܬܘܡܝܐ ܒܐܘܟܣܝܕ ܕܐܘܪܚܗ ܡܦܠܛ ܐܠܟܬܪܘܢܐ ܒܡܢܝܢܐ ١٧٠٠ ܩܠܝܘܬܐ ܒܗܘܢ ܕܐܝܬ ܗܘܐ ܡܦܠܛܐ ܒܝܕ ܐܝܘܢܝܬܐ ܡܢ ܓܙܐ. ܪܒܐ

ܕ. ܓܘܒܐ ܚܪܝܐ ܒܐܘܟܣܝܕܐ ܒܝ ܦܝܪ ܚܪܝܐ ܐܝܟܐ ܡܢ ܚܕܐ ܒܐܘܟܣܝܕܐ ܕܒܗܘܢ ܘܡܬܘܪܬܗܘܢ. ܐܘ ܓܘܒܐ ܡܦܠܛ ܐܠܟܬܪܘܢܐ ܒܡܢܝܢܐ ܕܚܫܝܫܘܬܐ ܒܦܘܬܐ ܦܫܝܛܐ ܐܝܟ ٧٠٠ ܥܠ ٧٥٠ ܕܪܓܐ ܩܠܝܘܬܐ

٢ . ܡܫܚܠܢܐ ܡܬܘܚܝܐ ܡܫܚܠܦܬܐ ܠܐ ܟܝܢܝܬܐ ܘܦܝܪ ܡܕܡ ܡܫܚܠܢܐ ܡܬܘܚܝܐ ܘܐܦܪ ܡܢ ܩܛܘܪܐ ܡܢ ܚܕ ܚܕܢܐ ܒܐܝܟܢܐ ܡܢ Heated cathode ܐܘܟܣܝܕܐ ܡܦܠܛܢܐ ܠܐܠܟܬܪܘܢܐ ܐܝܟ ܐܘܟܣܝܕܐ ܕܒܗܘܢ ܘܡܬܘܪܬܗܘܢ ܘܒܠܗܘܢ) ܘܡܛܠ ܗܢܐ ܐܝܬ ܐܝܟܐ ܕܡܫܚܠܢܐ ܡܢ ܓܙܐ. ܒܐܝܟܢ ܡܢ ܩܛܘܪܐ ܦܝܪ ܡܕܡ ܦܬܝܠܐ ܒܓܘ ܓܘܒܐ ܕܡܫܚܠܢܐ ܡܫܚ ܠܩܛܘܪܐ ܘܦܝܪܐ ܝܠܗ ܣܘܓܐ ܕܦܠܛܬܐ ܕܐܠܟܬܪܘܢܐ ܐܘ ܠܐ ܟܢܫܐ ܡܢ ܐܝܟܐ ܕܡܫܚܠܢܐ ܘܦܝܪܐ ܡܦܝܠܢܐ ܐܘ ܐܪܝܐ ܡܢ ܡܫܚܠܢܐ ܠܐ ܟܝܢܐ ܒܗܘ ܠܐ ܕܙܒܢܐ ܕܡܫܠܡܐ ܡܬܘܪܙܐ ܠܠܦܐ ܢܘܪܐ.

٩ ـ ٣ ܦܠܛܬܐ ܕܐܠܟܬܪܘܢܐ ܒܡܟܟܕܢܘܬܐ ܒܢܘܗܪܐ



ܨܘܪܬܐ (٩ - ٤) ܡܟܟܕܢܘܬܐ ܦܘܛܘܟܗܪܒܝܬܐ

ܦܠܛܬܐ ܕܐܠܟܬܪܘܢܐ ܡܢ ܚܘܕܐ ܐܘ ܙܦܚܐ ܕܚܘܫ ܡܫܚܠܢܐ ܐܝܟ ܕܦܝܪ ܡܬܘܡܝܐ ܒܚܘܕܐ ܐܘ ܒܠ ܘܠܒܝܬܐ ܡܕ ܟܝܢܐ ܠܚܡܝܐ ܦܝܪ ܡܕܡ ܒܡܟܟܕܢܘܬܐ ܦܘܛܘܟܗܪܒܝܬܐ (ܨܘܪܬܐ ٩ ـ ٤) ܘܚܐܠܗ ܗܕܡ ܠܗܘ ܒܝܘܡܬܐ ܠܗܘ ܡܕܡܐ ܫܢܬܐ ١٨٨٧ ܡ.

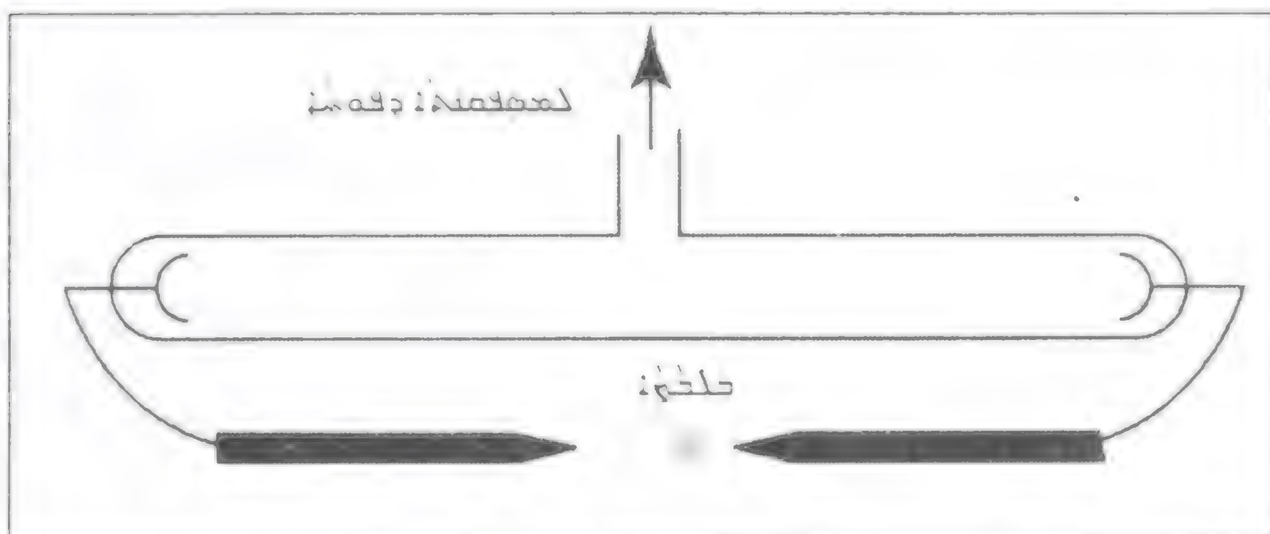
ܘܐܬܐ ܒܫܢܬܐ ܡܬܚܫܠܗ ܗܘܠ ܙܦܚܐ ܕܚܘܕܪ ܠܠܘܪܬܐ ܕܚܘܫܬܐ ܡܦܠܛܐ ܚܘܫܬܗ ܐܝܟ ܕܦܝܪܐ ܡܬܘܡܝܬܐ ܒܐܠܝܐ ܠܟܠ ܒܢܦܫܐ.

ܡܢ ܡܬܚܫܠܗ ܕܚܘܕܐ ܦܠܝܐ ܐܝܟ ܠܒܝܘܡ ܘܙܘܒܝܘܡ ܘܦܘܛܐܣܝܘܡ ܘܢܒܝܘܡ ܡܦܠܛܝܢ ܐܠܟܬܪܘܢܐ ܐܝܟ ܕܢܦܠ ܥܠܝܗ ܒܗܘܪܐ ܡܬܚܙܝܢܐ. ܘܐܬܐ

ܒܗܕܐ ܕܝܢ ܡܬܒܚܢܠܗ ܗܘܡܫ ܘܠܝܢܕܒ ܕܦܘܠܚܢܐ ܕܒܘܕܐ ܝܠܗ ܕܡܟܒܒ ܦܠܛܬܐ ܕܐܠܩܛܪܘܢܐ ܣܓܝܐ ܡܢ ܐܬܘܡܐ ܢܛܝܫܐ ܕܣܦܪܐ

(٩ - ٤) ܙܪܝܩܐ ܢܘܗܪܐ ܕܩܬܘܕܘܣ

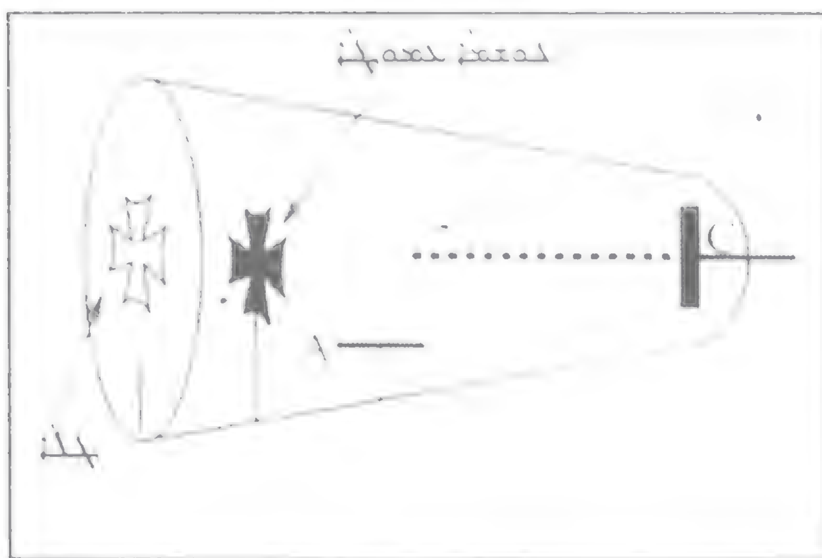
ܐ. ܦܬܠܗ ܡܘܡܝܬܐ ܐܢܘܢ ܕܗܦܡܐ ܒܡܘܡܝܬܐ ܕܠܒܦܐ ܕܪܘܡܟܪܘܦ ܒܣܘܣ ܕܟܠܟܝܐ ܐܢܐ ܒܣ ܗܪܘܝܗ ܡܘܡܝܬܐ ܕܠܒܦܐ ܐܝܟ ܕܗܘܐ ܡܪܝܬܐ ܡܢ ܣܓܝܐ ܘܐ. ܡܘܡܝܬܐܠ ܐܢܘܢܐ ܠܡܫܩܡܐ ܕܦܘܣܐ ܒܣܘܣ ܐܢܐ ܢܣܗܪܐ ܕܣܠܘܓܐ ܕܟܠܟܝܐ ܐܢܐ ܠܗ ܐܢܘܢܐ ܐܝܟ ܕܒܘܟܪܐ ܒܣ ܗܪܘܝܗ ܡܘܡܝܬܐ ܒܒ ܐܢܐ ܝܠܗ ܡܢ ܒܘܟܪܐ ܒܣ ܡܘܡܝܬܐ ܕܠܒܦܐ ܕܪܘܡܟܪܘܦ ܡܢ ܕܡܣܘܐ ܕܦܘܣܐ ܗܣܘܗ ܣܠܘܓܐ ܒܘܦܐ ܦܬܠܗ ܒܒ ܡܡܝܬܢܐ ܠܒܪܐܣܘܗܐ ܡܢ ܦܘܣܐ ܗܣܘܗ ܣܠܘܓܐ ܐܢܐ (ܐܘܚܡܐ ٩ ـ ٥) ܘܐ. ܐܝܬܠܗ ܗܦܡܐ ܕܦܘܣܐ ܠܗ ܐܢܘܢܐ ܗܠ ܕܦܬ ܣܠܘܓܐ (١) ܗܡ ܘܒܒܠ ܦܘܣܐ ܕܐܢܘܢܐ ܒܦܬ ܐܢܠܘܢܐ ܕܠܘܢܐ ܒܡ ܦܬ ܢܣܗܪܐ ܠܘܛܐ ܒܠܘܢܐ ܙܪܩܐ ܘܒܒܒܘ ܗܦܘܡܐ ܕܦܪܪ.



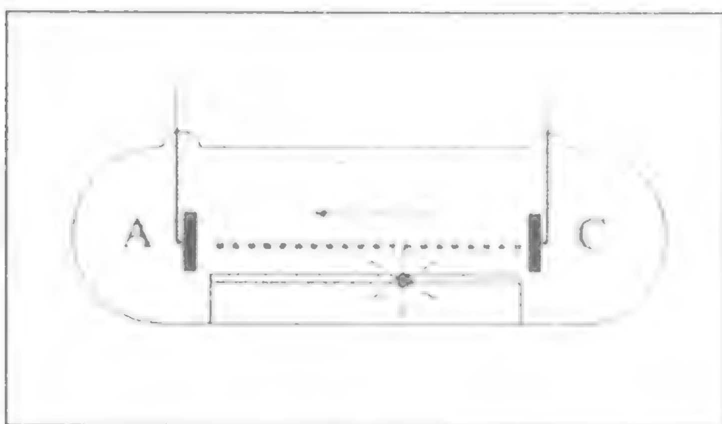
ܐܘܚܡܐ (٩ - ٥) ܡܘܡܝܬܐ ܕܠܒܦܐ ܕܠܪܓܐ (ܪܘܡܟܪܘܦ)

ܘܐ. ܦܬܠܗ ܣܠܘܓܐ ١٥٠ ܡܠܝܡܝܬܪ ܘܒܒܠ ܪܣܡܐ ܠܘܛܐ ܡܢ ܢܣܗܪܐ ܘܦܬܐ ܦܝܫܐ ܣܓܝܐ ܣܬܝܢܐ ܦܬܐ ܡܪܝܐ ܦܝܫܐ ܕܒܪܘܩ ܘܠܗ ܡܝܬܐ ܕܣܠܘܓܐ ܠ ١٠٠ ܡܠܝܡܝܬܪ ܘܒܒܠ ܒܡܠܢܐ ܦܝܫܐ ܕܒܪܘܩ ܗܘܝܐ ܕܐܢܘܢܐ ܘܡܠܡܐ ܠܘܛܐ ܘܦܠܛܐ ܙܪܝܩܐ ܠܐ ܡܬܚܙܝܢܐ ܡܢ ܢܣܗܪܐ ܦܬܐ ܡܪܝܐ ܙܪܝܩܐ ܢܘܗܪܐ (Cathode Rays) ܘܡܛܠ ܠܡܬܡܘܝܐ ܠܠܘܪܐ ܦܠܛܐ ܡܢ ܢܣܗܪܐ ܒܠܘܠܘܛܐ ܠܒܘܪܐ ܐܦܐ ܘܐܝܬܠܗ ܕܠܝܬܐ ܡܢܗ:

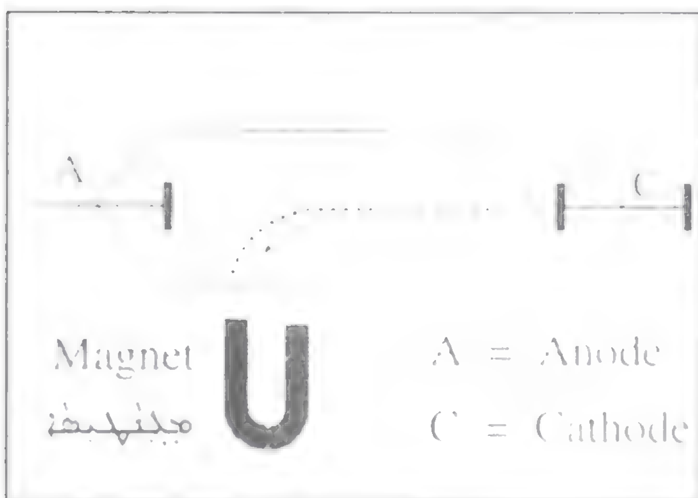
١ . ܦܠܘܪܐ : ܐ. ܢܦܠܠܗ ܙܪܝܩܐ ܢܘܗܪܐ ܥܠ ܡܠܚܐ ܕܗܘܠܐ ܡܒܗܒܐ ܒܠܘܛܐ ܒܠܘܢܐ ܕܠܠܝܐ ܒܣ ܠܗ ܕܠܝܬܐ ܕܗܘܠܐ ܦܠܘܪܐ ܘܡܠܚܐ ܕܒܪܐ ܠܘܛܐ ܒܠܘܢܐ ܙܪܩܐ ܡܢ ܠܘܦܐ.



ܨܘܪܬܐ (٩ ـ ٦)



ܨܘܪܬܐ (٩ ـ ٧)



ܨܘܪܬܐ (٩ ـ ٨)

٢ ـ ܦܵܪܫܝܼ ܒܚܘܼܛܵܐ ܬܪܝܼܨܵܐ ܘܐܝ ܒܪܓܠܐ ܠܝܗ ܠܘܬܡܐ ܣܬܒܢܐ ܠܗ ܡܠܢܐ ܡܣܘܦܬܐ (ܨܠܝܒܐ ܕܨܘܪܬܐ ٩ ـ ٦) ܒܪܬܡܝ ܝܠܐ ܓܠ ܘܓܘܓܝܬܐ.

٣ ـ ܐܝܬ ܠܝܗ ܡܕܒܪܢܘܬܐ ܡܟܢܝܟܝܬܐ : ܐܝ. ܦܠܚܠܗ ܡܢ ܢܣܒܬܐ ܕܡܘܪܢܐ ܨܘܪܬܐ (٩ ـ ٥) ܒܦܩܝ ܒܡܚܙܪܘܗܝ ܕܓܠܘܠܘܬܗ ܘܐܝ ܦܝܫܠܗ ܡܘܬܒܐ ܕܒܢܝܐ ܡܢ ܦܠܚܝ ܒܢܘܦܐ ܒܦܪܢܐ ܚܘܝܐ ܪܡܐ ܕܪܕܝܐ ܕܡܟܝܢܘܬܐ ܕܦܠܚܝ ܠܪܕܝܐ ܕܬܡܝܡܐ.

٤ ـ ܐܝܬ ܠܝܗ ܡܕܒܪܢܘܬܐ ܡܓܢܝܛܐ : ܐܝ. ܦܝܫܠܗ ܡܫܘܚܢܐ ܘܗܪܢܐ ܢܣܒܬܐ ܓܠ ܓܠܠܐ ܡܢ ܡܓܢܐ ܠܓܠ ܗܘܐ ܒܦܪܥܝ ܨܘܪܬܐ (٩ ـ ٧).

٥ ـ ܦܠܛܝ ܒܗܕ ܓܝܓܠܐ ܡܓܢܛܝܣܝܐ ܨܘܪܬܐ (٩ ـ ٨).

٦ ـ ܦܠܛܝ ܒܗܕ ܓܝܓܠܐ ܒܗܪܒܢܐ.

(٩ ـ ٥) ܙܢܝܐ ܕܪ̈ܒܢܐ

ܒܬܪܐ : ܦܬܒ ܐܘܪܢܝܐ ܙܢܝܐ ܐܠܟܬܪܘܢܝ ܒܬܪܝ ܐܘܪܚܬܐ :

ܡܕܡܐ : ܠܚܘܕ ܗܘܦܐ ܕܐܝܬ ܠܗ ܙܢܝܐ ܐܠܟܬܪܘܢܝܐ ܒܪܬ ܡܦܡܬܗ ܘܟܠܗ ܒܬܪܝ ܐܘܪܚܐ : ܡܕܡܐ ܙܢܝܐ ܡܢ ܚܠܘܨܐ ܒܗܘܦܐ ܘܦܝܫܠܗ ܡܪܝܐ ܒܡܪܐ

ܦܫܝܛܐ ܓܠܝܬܐ ܒܕ ܚܒܝܒ ܕܬܐ ܡܠܝܠ ܡܢ ܒܡܬܬܐ ܕܦܘܫܐ ܐܝܟܐ ܕܠܐ ܡܟܒܒ
ܟܠ ܟܒܪܐ ܕܙܡܪܐ

ܘܐܦܢ ܐܕܝܢ **ܠܦܘܬ ܡܫܢܝܬܐ ܕܡܘܠܕܐ** ܕܦܠܚ ܐܝܟ ܗܘܡܐ ܬܡܢ ܠܗ ܦܠܚܝܢ ܒܗܘ ܕܐܘܐ ܙܡܪܐ ܕܒܟܒܐ ܐܕܝ ܡܘܠܕܐ ܚܕ ܡܚܝܢ ܡܫܡܢܐ ܐܘ ܝܦܝܫܐ ܘܐܕܢܝܐ ܡܒܫܠܬܐ ܦܪ ܡܕܐ ܙܡܪܐ ܐܕܝܢܐ ܕܗܘܝ ܗܘܠܗ ܐܕܝ ܡܒܘܫܐ ܓܠ ܡܘܠܕܐ ܘܙܡܪܐ ܐܠܟܬܪܐ (ܐܠܩܛܪܘܕ Electrode) ܘܡܕܒܪܢܐ ܕܒܝܬܐ ܘܡܚܝܢܐ ܘܡܬܒܬܐ .. ܒܪܬܐ.

(٩ ـ ٦) ܫܘܪܝܐ ܕܙܡܪܐ ܐܕܝܢܝܬܐ ܓܠܝܬܐ ܕܦܫܛܘܬܐ

ܗܘ ܦܠܡܢܓ ܢܒܘܠܐ ܐܢܓܠܝܐ ܦܠܡܢܓ ܒܫܢܬܐ ١٩٠٤ ܡܚܒܪܢܘܬܐ ܕܐܕܝܢܘ. ܠܗ ܡܠܬܐ ܕܓܠܐ ܕܒܘܫܐ ܒܡܬܒܬܐ ܕܝܦܝܫܬܐ ܡܢ ܣܦܪܐ ܒܕܘܒܠ ܠܒܘܪܐ ܕܓܠܡܐ ܐܝܟ ܕܡܕܡܠܘ ܘܡܟܒܠܘ ܐܕܝܢܘ. ܘܓܠܝܠܘ ܕܓܠܡܐ ܦܠܚ ܐܝܟ ܙܡܪܐ.

ܘܐܕܝ ܙܡܪܐ ܐܕܝܢܐ ܡܢ ܬܪܬܐ ܘܠܗ ܠܒܝܬܐ ܡܫܘܦܪܐ ܡܢ ܦܘܫܐ ܠܗܘ ܐܕܝ ܡܘܠܕܐ ܠܗ ܡܒܫܠܬܐ (ܟܬܘܕ) ܘܡܫܡܢܐ (ܐܢܘܕ) ܘܚܕ ܡܡܠܢܝܬܐ ܐܝܟܐ ܦܠܚܝܬܐ ܠܟܪ ܕܙܡܪܐ ܠܗ ܦܘܫܐ.

ܘܨܘܪܬܐ (٩ ـ ٩ ܐ) ܚܙܝ ܫܘܪܝܐ ܕܙܡܪܐ ܐܕܝܢܐ ܥܡ ܡܒܫܠܬܐ ܬܪܝܨܬܐ
ܘܨܘܪܬܐ (٩ ـ ٩ ܒ) ܚܙܝ ܫܘܪܝܐ ܕܙܡܪܐ ܐܕܝܢܐ ܥܡ ܡܒܫܠܬܐ ܠܐ ܬܪܝܨܬܐ

(ܨܘܪܬܐ ٩ ـ ٩ ܐ)
ܡܒܫܠܬܐ ܬܪܝܨܬܐ

(ܨܘܪܬܐ ٩ ـ ٩ ܒ)
ܡܒܫܠܬܐ ܠܐ ܬܪܝܨܬܐ

(٩ ـ ٧) ܕܘܒܪܐ ܕܙܪܡܐ ܚܕܢܝܐ

ܦܠܝܫ ܙܪܡܐ ܚܕܢܝܐ ܕܡܫܡܫܘܬܐ ܒܠܢܐ ܕܚܘܡܐ ܒܡܬܚܝܢܬܐ ܕܡܫܚܢܐ ܒܝܢ ܬܪܬܝ ܐܘ ܡܚܘܟܢܐ ܕܠܦܐ ܢܘܪܢܐ ܘܦܝܬ ܡܫܚܢܐ ܡܚܘܟܢܐ ܠܐ ܠܐܠܟܛܪܘܢܐ ܒܙܘܥܐ ܣܘܝܫܐ ܒܡܠܘܠܘܬܐ ܒܕܘܟܬܐ ܕܟܐ ܘܟܘܪܬܐ ܕܦܬܝ ܠܐܕܪܬܐ ܕܒܝܬܐ ܠܟܠ ܡܫܚܢܐ ܦܬܐ ܡܕܝܬܐ ܒܚܘܝܬܐ ܕܗܘܦܡܐ ܘܦܠܫܐ ܥܠ ܡܘܠܕܬܐ ܕܫܠܐ ܕܢܦܪܬܐ ܥܡ ܐܠܟܛܪܘܢܐ ܕܦܠܛܝ ܡܢ ܡܫܚܢܐ. ܡܢܢܐ ܡܠܝܐ ܡܢ ܐܠܟܛܪܘܢܐ ܡܢܝ ܕܦܬܝ ܐܝܟ ܚܘܝܬܐ ܕܗܘܦܡܐ ܘܦܬܢܐ ܡܚܠܝ ܡܢ ܚܒܪܬܐ ܕܚܘܝܬܐ ܕܗܘܦܡܐ ܐܠܐ ܐܝ ܒܡܫܠܛܝܗ ܣܕܪܐ ܐܠܟܛܪܘܢܐ. ܘܐܝ ܒܕܠܘܓ ܠܓܦܫܬܐ (ܡܗܡܢܐ) ܗܘܡܐ ܠܦܘܫ ܡܫܚܢܐ ܐܠܟܛܪܘܢܐ ܒܢܦܩܝ ܙܘܥ ܡܗܡܢܐ ܒܘܕ ܕܐܘܐ ܡܓܝܬܐ ܠܗ ܗܠܝܬܐ ܕܠܦܐ ܗܠܡܢܐ ܒܝܕ ܐܡܝܕ ܠܗ ܕܘܪܐ ܕܡܗܡܢܐ. ܘܐܨܘܪܬܐ (٩ ـ ١٠) ܚܘܝܐ ܡܚܘܝܢܐ ܕܙܪܡܐ ܚܕܢܝܐ ܒܡܫܚܢܬܐ ܠܐ ܕܪܬܐ.

ܐܨܘܪܬܐ (٩ ـ ١٠)

ܘܐܢ ܦܬܠܗ ܟܘܪܢܐ ܕܡܗܡܢܐ ܠܠܘܪܐ ܠܦܘܫ ܡܫܚܢܐ ܐܨܘܪܬܐ (٩ ـ ١١) ܒܡܕܪܘ ܠܡܘܚܒܐ ܠܠܘܪܐ ܕܡܚܘܟܢܐ ܐܠܟܛܪܘܢܐ ܒܢܦܩܝ ܕܣܡܐ ܡܢ ܡܗܡܢܐ ܒܘܕ ܕܐܘܐ ܠܐ ܟܝܕ ܠܦܐ ܒܘܪܬܐ.

ܘܠܐܘܐ ܥܠܬܐ ܦܬܠܘ ܡܕܢܐ ܒܙܪܡܐ ܐܠܟܛܪܘܢܐ ܒܥܠܬܐ ܕܡܚܘܝܘ ܠܦܐ ܒܝܕ ܙܘܥܐ ܘܐܝ ܡܫܓܠܘܓ ܒܘܚܘܝܬܐ ܢܘܟܪܝܬܐ ܥܠ ܡܗܡܢܐ. ܡܫܚܢܐ ܠܦܐ ܒܟܝܕ ܒܝܕ ܙܘܥܐ ܒܘܕ ܕܐܘܐ ܦܬܐ ܐܡܝܪܬܐ ܕܙܪܡܐ ܦܠܝܫ ܐܝܟ ܡܚܕܪܢܐ

. rectifier

ܐܨܘܪܬܐ (٩ ـ ١١)

٩ ـ ٨) ܡܦܠܚܢܘܬܐ ܕܙܘܥܐ ܒܪ̈ܢܝܐ ܐܝܟ ܡܬܪܨܢܐ ܕܚܝܠܐ

ܡܬܪܨܢܐ ܗܘ ܒܘܨܝܐ ܕܡܫܚܠܦ ܚܝܠܐ ܗܦܟܐ (ܐܘ ܟܘܠܚܢܘܬܐ ܗܦܟܬܐ) ܠܚܝܠܐ ܐܘ ܟܘܠܚܢܘܬܐ) ܟܕ ܙܘܓܐ. ܡܬܪܨܬܐ ܕܚܝܠܐ ܗܦܟܐ ܒܝܕ ܡܦܠܚܢܘܬܐ ܕܙܘܥܐ ܒܪ̈ܢܝܐ ܕܡܫܚܠܦ ܚܝܠܐ ܟܕ ܙܘܓܐ ܘܐܝܬ ܐܝܟ ܗܘܐ ܡܫܡܫܢܐ ܫܘܡܐ ܠܗܘ ܡܣܝܒܐ ܐܠܐ ܠܐ ܚܕ ܚܝܠܐ ܐܝܟ ܗܘܐ ܡܫܡܫܢܐ ܠܚܘܕ ܠܗܘ ܡܣܝܒܐ ܘܐܚܙܝܬܐ (٩ ـ ١٢) ܚܙܝ ܡܪܐ ܕܦܠܓܐ ܕܓܠܐ.

ܐܚܙܝܬܐ (٩ - ١٢) ܚܙܝ ܡܪܐ ܕܦܠܓܐ ܕܓܠܐ ܒܦܠܓܐ ܕܚܘܪܐ

ܐܚܙܝܬܐ (٩ - ١٣) ܣܟܡܐ ܗܘ ܕܚܝܠܐ ܒܟܠܝܐ ܒܚܘܪܐ ܒܗܘܐ ܡܢ ܚܕ ܙܘܓܐ

(٩ - ٩) ܪܘܟܒܐ ܕܨܦܘܦܬܐ ܬܠܝܬܝܐ

ܠܒܬܪ ܦܘܠܚܢܐ ܕܨܦܘܦܬܐ ܬܪܝܢܝܬܐ ܥܠ ܡܬܕܪܟܬܐ ܘܬܚܬܝܗ ܡܬܝܢܘܬܐ ܥܠ ܪܘܪܒܘܬܐ. ܒܗܘ ܕܐܗܐ ܡܘܕܥܠܗ ܐܒܘܟܪܐ ܕܝ ܦܘܪܣܬ ܫܢܬܐ ١٩٠٦ ܡ ܡܘܦܩܐ ܬܠܝܬܝܐ ܒܝܢ ܡܢܝܚܬܐ ܘܡܢܣܒܢܬܐ ܘܒܗܘ ܕܐܗܐ ܦܫܠܗ ܡܕܪܐ ܒܨܦܘܦܬܐ ܬܠܝܬܝܐ ܘܗܘܐ ܐܗܐ ܡܘܦܩܐ ܒܐܫܒܝܢܐ ܕܫܒܒܐ ܡܕܪ ܒܡܢܝܚܬܐ ܘܗܘ ܒܪܕܗ ܦܝܫ ܒܕܒܪܐ ܒܡܢܣܒܢܬܐ ܘܗܘܐ ܐܢ ܡܐܠܐ ܚܠܘܨܐ ܐܘ ܒܐܫܒܝܢܐ ܕܦܩܝܐ ܐܘ ܡܦܠܘܬܐ ܠܗܘ ܦܫܝܚܐ ܠܒܕܪܬܐ ܕܐܠܩܛܪܘܢܐ ܡܢ ܡܢܝܚܬܐ ܠܡܢܣܒܢܬܐ. ܦܝܫ ܪܡܝܙܐ ܠܨܦܘܦܬܐ ܬܠܝܬܝܐ ܒܪܡܙܐ ܨܦܘܦܬܐ ܬܪܝܢܝܬܐ ܡܘܕܝܒܐ ܥܠܗ ܚܛܐ ܡܢܝܙܐ ܒܝܢ ܡܢܝܚܬܐ ܘܡܢܣܒܢܬܐ ܘܗܘ ܦܘܫ ܫܒܒܐ ܐܫܒܝܢܐ (٩ - ١٤).

ܐܫܒܝܢܐ ٩ - ١٤
ܨܦܘܦܬܐ ܬܠܝܬܝܐ

ܘܒܕ ܫܒܒܐ ܢܦܠܐ ܝܠܗ ܒܐܘܪܚܐ ܕܫܒܘܩܐ ܐܠܩܛܪܘܢܐ ܘܡܕܒܪܐ ܝܠܗ ܡܢ ܡܢܝܚܬܐ ܕܝܠܗ ܡܒܘܥܐ ܕܐܠܩܛܪܘܢܐ ܐܝܟܠܗ ܡܬܝܢܐ ܥܠ ܫܠܝܛܬܐ ܒܐܘܪܚܐ ܕܐܠܩܛܪܘܢܐ ܕܡܘܠܕܝ ܠܦܐ ܕܡܫܚܢܘܬܐ ܒܗܘ ܕܐܗܐ ܦܫܠܗ ܡܕܪܐ ܫܒܒܐ ܕܫܠܝܛܬܐ.

ܘܒܘܠܛܘܬܐ ܗܕܟܐ ܒܝܢ ܫܒܒܐ ܘܡܢܝܚܬܐ ܦܫܐ ܡܕܝܟܐ ܒܒܘܠܛܘܬܐ ܕܡܣܠܩܢܘܬܐ.

(٩ - ١٠) ܡܫܟܚܢܘܬܐ ܕܒܘܠܛܘܬܐ ܕܡܣܠܩܢܘܬܐ ܥܠ ܠܦܐ ܕܡܫܚܢܬܐ

١ - ٢. ܦܫܠܗ ܡܘܦܩܐ ܒܘܠܛܘܬܐ ܗܘܡܟܐ ܘܝܘܪܬܐ ܥܠ ܫܒܒܐ ܙܥܘܪ ܠܦܐ ܕܡܫܚܢܬܐ ܐܘ ܫܒܒܐ ܢܦܩ ܒܟܕܪܐ ܒܐܝܟ ܚܕܟܡܐ ܡܢ ܐܠܩܛܪܘܢܐ ܘܡܘܠܕ ܠܦܐ ܠܗ ܕܦܪܝܗ ܡܫܟܚܢܐ ܛܠܡܬܐ ܕܚܕܟܡܐ ܡܬܝܢܘܬܐ ܥܠ ܣܘܓܐܐ ܕܪܘܪܒܘܬܐ ܕܡܫܚܢܬܐ.

٢ - ٢. ܦܫܠܗ ܒܘܠܛܘܬܐ ܕܫܒܒܐ ܡܦܩܐ ܠܦܘܡ ܡܢܝܚܬܐ ܒܝܠܗ ܐܦܢܝܬܐ ܦܝܫ ܨܦܘܦܬܐ ܬܪܝܢܝܬܐ.

٣ . ܓ . ܦܬܠܘ ܒܘܠܛܢܘܬܐ ܕܒܢܒܢܐ ܠܠܘܪܐ ܠܦܘܡ ܡܫܚܠܦܢܐ ܒܕ ܡܫܚܢܐ ܠܦܐ ܕܡܫܡܫܢܐ

٤ . ܕ . ܘܒܕܠܘ ܒܘܠܐ ܕܒܘܠܛܢܘܬܐ ܠܠܘܪܐ ܕܒܢܒܢܐ ܕܬܠܛܢܬܐ ܒܝܕ ܠܦܐ ܕܡܫܡܫܢܐ ܠܢܦܩܬܐ ܕܐܠܩܛܪܘܢܐ ܙܘܥ ܡܫܚܠܦܢܐ ܘܠ ܕܦܫ ܐܘܐ ܠܦܐ ܗܦܡܐ ܒܘܠܛܢܘܬܐ ܠܠܘܪܐ ܕܒܢܒܢܐ ܒܐܘܐ ܐܚܢܢܘܬܐ ܦܬܐ ܡܕܢܐ ܒܒܘܠܛܢܘܬܐ ܕܡܙܠܠܢܘܬܐ ܡܠܛܢܬܐ. ܘܠܘ ܒܘܠܛܢܘܬܐ ܠܠܘܪܐ ܒܒ ܒܙܘܕܐ ܕܒܢܒܢܐ ܕܬܠܛܢܬܐ ܡܠܛܢܐ ܠܡܙܠܛܢܬܐ ܕܙܘܥܐ ܠܠܦܐ ܠܒܒ ܒܘܠܛܢܘܬܐ ܡܕܚܕܬܐ ܕܡܫܡܫܢܐ.

(٩ - ١١) ܡܦܠܚܢܘܬܐ ܕܙܘܥܐ ܕܠܒܢܐ ܐܝܟ ܡܓܒܪܢܐ

ܨܘܪܬܐ (٩ - ١٥) ܕܘܪܐ ܕܡܘܓܒܪܢܘܬܐ ܘܡܓܒܪ ܡܐܘܪܝܢܐ

ܦܘܠܚܢܐ ܐܚܝܢܐ ܕܙܘܥܐ ܕܠܒܢܐ ܓܠܝܐ ܕܗܦܡܢܬܐ ܝܠܘ ܠܓܘܡܬܐ ܕܓܡܪܐ ܢܘܦܐ ܘܚܘܕܐ ܐܘ ܒܘܠܛܢܘܬܐ ܢܘܦܢܬܐ ܘܚܘܕܬܐ ܐܝܟ ܗ. ܦܠܛܢܬܐ ܡܢ ܠܡܠܛܢܬܐ ܐܘ ܒܘܠܛܢܘܬܐ ܘܚܘܕܬܐ ܠܓܒܝܬܐ ܒܙܕܪܐ ܕܓܘܫܡܐ. ܕܝܠܬܐ ܕܠܓܘܡܬܐ ܠܙܘܥܐ ܕܠܒܢܐ ܒܥܡܪܘܬܐ ܠܒܕܪܐ ܕܒܘܣܠܦܐ ܘܚܘܕܐ ܠܗܘ ܒܘܠܛܢܘܬܐ ܕܒܢܒܢܐ ܡܙܐ ܕܡܘܠܕ ܒܘܣܠܦܐ ܠܒܘܕܐ ܒܚܘܒܢܐ ܡܢ ܠܗ ܚܘܪܢܐ ܕܠܓܢܐ ܕܡܫܡܫܢܐ ܒܕ ܦܬ ܒܡܠܐ ܚܘܪܢܐ ܠܒܘܕܐ ܗܘ. ܦܬܠܘ ܡܘܕܒܢܐ ܕܡܙܐ ܢܘܦܢܐ ܥܠ ܒܢܒܢܐ ܘܚܘܕ ܘܒܘܣܠܦܐ ܕܒܘܠܛܢܘܬܐ ܕܒܢܒܢܐ ܗܘܐ ܠܓܒܢܐ ܐܦ ܘܒܢܐ ܠܦܐ ܕܡܫܡܫܢܐ ܘܒܘܠܛܢܘܬܐ ܕܡܫܡܫܢܐ ܠܓܒܢܐ ܡܢ ܠܗ ܡܚܡܝܐ ܕܡܦܠܚܢܬܐ ܕܙܘܥܐ ܘܐܘܐ ܗܘܦܠܘ ܝܠܘ ܕܒܘܠܛܢܘܬܐ ܘܚܘܕܬܐ ܦܬܐ ܡܘܕܒܢܬܐ ܒܒܘܕܬܐ

ܕܒܝܬܐ. ܡܚܝܕܬܐ. ܐܠܐ ܐܝܟ ܒܠܫܢܘܬܐ ܒܪܘܪܬܐ ܒܡܘܪܬܐ ܕܡܗܡܢܝܬܐ.
ܡܚܝܕܬܐ ܐܘܐ ܕܝܠܗܐ ܝܠܗ ܒܕܘܡܝܐ ܕܒܠܫܢܘܬܐ.

ܦܝܫܘܬܐ ܕܒܠܫܢܘܬܐ ܒܗ ܕܘܪܬܐ ܕܡܗܡܢܝܬܐ ܠܒܠܫܢܘܬܐ ܒܓܪܓܪܬܐ ܠܕܘܪܬܐ ܕܒܝܬܐ ܦܬܐ ܡܘܡܕܝܬܐ ܒܕܘܡܝܬܐ ܕܒܠܫܢܘܬܐ.

٩ - ١٢) ܚܙܝܢܝܬܐ ܕܓܪܓܪܢܝܬܐ (ܐܘܣܝܠܘܣܟܘܦ) Oscilloscope

ܗܘܝܐ ܐܝܟ ܗܘ ܚܙܝܢܝܬܐ ܕܓܪܓܪܢܝܬܐ ܝܠܗ:

١ - ܡܒܘܥܐ ܕܐܠܟܬܪܘܢܐ (١)

٢ - ܡܬܪܘܨܬܐ ܠܟܢܫܘܬܗ ܕܩܪܢܐ ܒܚܕ ܢܩܘܙܐ ܒܠܚܘܕ (٢)

ܨܘܪܬܐ (٩ - ١٦)

٣ - ܡܬܪܨܢܐ ܠܡܦܠܓܬܐ ܕܩܪܢܐ ܕܐܠܟܬܪܘܢܐ (٣)

٤ - ܬܪܝ ܡܫܡܝܢܐ (X - Y) ܠܡܪܘܒܬܐ ܕܩܪܢܐ ܕܐܠܟܬܪܘܢܐ (٤).

٥ - ܦܬܐ ܦܠܘܪܐ (٥).

ܡܒܘܥܐ ܕܐܠܟܬܪܘܢܐ ܝܠܗ ܡܚܝܕܬܐ ܡܘܚܝܢܐ ܡܚܝܢܬܐ ܠܐ ܪܚܝܩܬܐ ܡܢ ܐܒܘܬܐ ܡܫܘܚܠܦܐ ܫܘܡܠܝܐ ܥܠܝܬܐ ܘܒܝܬܐ ܕܐܠܟܬܪܘܢܐ ܡܢ ܒܠܫܢܘܬܐ ܐܠܘܝܬܐ ܡܫܬܠܛܐ ܒܗ ܡܚܝܕܬܐ ܝܠܗ ܒܫܠܛܬܐ ܕܦܠܛܬܐ ܕܐܠܟܬܪܘܢܐ ܘܫܠܛܬܐ ܕܪܡܫܬܐ ܕܩܪܢܐ ܥܠ ܦܬܐ.

ܘܬܪܝ ܡܪܘܒܬܐ ܕܐܠܟܬܪܘܢܐ ܦܠܛܐ ܒܝܕ ܬܪܝ ܡܫܡܝܢܐ X - Y ܦܝܫ ܡܘܬܒܐ ܥܠܗ ܒܠܫܢܘܬܐ ܥܠܝܬܐ ܒܦܫܘܛܐ ܠܡܚܝܕܬܐ

ܘܦܝܫ ܡܗܘܦܟܐ ܒܫܘܠܐ ܒܝܕ ܡܘܓܒܐ ܐܪܙ ܝ ܡܢ ܡܓܘܢܐ ܣܦܪܐ ܐܘ ܐܪܝ
ܡܕܝܢ ܒܩܕܡܝ ܠܒܘܫܐ ܦܪܨܘܦܐ ܦܝܫ ܡܘܐܒܐ ܟܠܗ ܒܘܠܒܘܬܐ ܠܠܘܝܐ
ܠܒܡܝܬܐ ܕܐܠܟܬܪܘܢܐ ܢܦܩܝ ܡܢ ܟܠܗ ܙܘܓܐ ܒܘܕ ܕܐܗܐ ܡܫܬܕܪܝ ܡܟܘܪܙܐ
ܒܒܘܡܐ ܘܡܙܝܢܬܐ ܠܗ ܒܫܠܦܬܐ ܕܒܓܫܘܬܐ ܕܡܓܢܛܐ ܕܒܒܘܡܐ ܒܝܕ
ܒܫܠܦܬܐ ܕܟܘܒܢܐ ܠܠܘܝܐ ܕܐܗܐ ܡܓܘܢܐ ܘܦܝܫ ܡܕܝܐ ܡܓܒܡܢܐ ܕܡܘܠܟܬܐ
ܕܒܝܘܡܐ ܐܠܟܬܪܘܢܐ ܒܪܡܝܬܐ ܐܠܟܬܪܘܢܝܐ.

ܐܢ ܡܓܒܡܢܐ ܕܦܠܛܐ ܐܪܙ ܡܢ ܐܪܝ ܙܦܝܬܐ ܡܚܘܝܢܐ (ܐ) ܦܝܫ ܢܝܟܠܐ ܒܙܦܝܬܐ ܕܦܠܛܐ ܐܘܦܡܝܬܐ) ܘܐܪܝ ܙܦܝܬܐ (ܒ) ܦܝܫ ܢܝܟܠܐ ܒܙܦܝܬܐ ܕܦܠܛܐ ܝܡܦܬܐ. ܘܐ. ܦܝܫܠܘ ܐܡܝܪܐ ܡܒܘܟܐ ܕܒܘܠܒܘܬܐ ܐܡܝܢܬܐ ܥܠ ܐܪܘܝܗ ܙܦܝܬܐ ܙ ܐܠܟܬܪܘܢܐ ܒܢܐܦ ܙܘܒ ܙܦܝܬܐ ܗܘܡܬܐ ܘܒܘܕ ܕܐܗܐ ܦܠܡܝ ܠܟܠ ܐܢܝ ܒܐܣܟܝܡܐ (٩ - ١٧).

ܐܣܟܝܡܐ ٩ - ١٧

ܘܐ. ܦܝܫܠܘ ܡܘܐܒܬܐ ܒܘܠܒܘܬܐ ܐܡܝܢܬܐ ܥܠ ܐܪܘܝܗ ܙܦܝܬܐ ܙ ܒܒܘܡܐ ܒܦܠܛ ܒܝܘܒܐ ܠܟܠ ܘܠܡܝܐ ܒܘܕ ܕܐܗܐ ܒܪܒܡܐ ܫܦܝܐ ܐܪܝܝܐ ܘܡܦܐܝܬ ܥܠ ܗܕܪܐ ܘܗܪ ܗܪܓ ܐ. ܦܝܫܠܘ ܡܘܐܒܬܐ ܒܘܠܒܘܬܐ ܐܡܝܢܬܐ ܥܠ ܐܪܘܝܗ ܙܦܝܬܐ ܗ ܒܪܒܡܐ ܫܦܝܐ ܐܘܦܡܝܐ.

ܐ. ܦܝܫܠܘ ܦܠܠܒܬܐ ܠܠܠܬܐ ܕܒܘܫܠܦܐ ܘܒܝܢܐ ܠܟܠ ܕܡܝܐ ܒܗܪܒܐ ܒܘܠܒܘܬܐ ܕܪܡܝܐ ܐܗܐ ܦܝܫܐ ܒܘܠܒܝܢܬܐ ܥܠ ܐܪܘܝܗ ܙܦܝܬܐ ܙܪܝܐ ܘܟܠܟܝܢܐ ܒܝܗ ܦܝܫܐ ܒܘܠܒܝܢܬܐ ܒܘܠܒܘܬܐ ܐܡܝܢܬܐ ܥܠ ܐܪܘܝܗ ܙܦܝܬܐ ܗܡܟܬܐ ܐܝܟܐ ܕܝܪܟܐ ܐܗܐ ܒܘܠܒܘܬܐ ܒܓܒܡܐ ܒܪܝܬܐ ܡܢ ܗܦܡܐ ܘܒܘܦܐ ܒܗܟܢܐ ܝܕ ܥܠ ܗܕܪܐ ܒܠܘܠܘܬܐ ܗܟܝܬܐ ܒܝܘܒܐ ܐܘܦܡܐ ܘܒܪܒܡܐ ܐܣܟܝܡܐ

ܕܡܣܘܐ ܥܠ ܗܕܐ. ܘܡܛܠ ܕܐܦ ܐܢܫ ܠܐ ܡܫܟܚ ܗܟܝܠ ܕܢܗܘܐ ܗܕܐ ܡܢ ܗܕܐ
ܠܡܬܕܪܟܘ ܐܘ. ܦܫܝܩܐ ܡܚܘܝܐ ܕܝܢ ܠܡܠܦܢܐ ܗܠܝܢ ܕܡܬܕܪܫܝܢ. ܒܡܫܘܐ ܕܦܫ
ܘܡܘܕܝܐ ܥܠ ܗܕܐ ܕܡܫܠܡܐ ܠܡܬܠܡܕܐ ܕܐܦ ܐܢܫ ܡܥܝܢܐ ܦܫ ܡܕܪܫ
ܒܦܘܠܚܢܐ ܕܐܦܐ ܕܒܢܝܐ.

ܐܠܐ ܗܫܐ ܦܘܠܚܢܐ ܗܠܝܢ ܡܢ ܠܘܬܐ ܕܠܘ ܒܠܚܘܕ ܦܫ ܥܒܕܐ ܒܡܘܠܐ
ܦܘܠܚܢܐ ܐܝܟ ܡܘܕܥܐ ܡܢ ܗܕܐ. ܕܡܠܦܢܘܬܐ ܘܡܫܠܡܐ ܕܐܢܫܐ ܘܐܝܟ
ܕܢܥܒܕ ܐܠܗܘܬܐ ܡܢ ܡܫܠܡܢܐ ܥܠܡܐ ܒܐܪܐ ܒܥܝܢܐ ܒܡܦܠܓ ܒܗܕܐ
ܘܡܦܩܢܐ ܠܗ ܣܘܟܐ ܕܡܬܕܪܫܐ ܒܠܫܢܐ ܣܘܪܝܝܐ.

ܫܘܐܠܐ

ܫ١ : ܡܠܝ ܠܦܣܘܩܝܬܐ ܕܠܬܚܬ :

١ . ܐܢܐ ܝܘܡܢܐ ܡܢ ܗܘܦܟܐ ܥܠܡܐ ܦܝܫ ܡܘܬܚܡܢܐ ܒܐܘܦ ܡܗܘܪܐ ܡܢ ܕܝܠܗ . ܡܬܚܡܢܐ ܕܒܗܐ ܒܝܬܐ

٢ . ܡܬܚܡܢܬܐ ܒܡܕܒܪܢܘܬܐ ܠܗܘܠܐ ܗܡܘܗ ܣܠܘܪܐ ܒܗܦܟܐ ܗܘܢܐ

ܡܢ ܡܬܚܡܢܬܐ ܒܡܕܒܪܢܘܬܐ ܠܗ ܗܡܘܗ ܣܠܘܪܐ ܥܠܡܐ .

٣ . ܒܕܪܐ ܒܗܠܝܢܘܬܐ ܒܡܬܚܠܝܢܘܬܐ ܐܢܐ ܝܘܡܢܐ ܗܠܝܗܐ ܐܝܟ

٤ . ܐܝܟ ܒܡܠܐ ܦܝܫܐ ܒܡܕܘܒܘ ܒܠ ܐܒܘܬܐ ܕܪܘܒܝܬܐ ܢܫܡܐ ܪܘܒܝܬܐ ܦܠܚܐ ܒܝܗ ....

٥ . ܦܝܫ ܝܘܡܢܐ ܗܠܝܗܐ ܗܕܢܐ ܐܝܟ .

٦ . ܦܠܚ ܝܘܡܢܐ ܗܕܢܐ ܥܠ ܡܬܚܡܢܬܐ ܕܐܦܐ ܐܢܐ ܒܘܕܐ ܒܡܕܒܪܢܘܬܐ ܐܝܟ

٧ . ܦܝܫ ܡܕܢܐ ܢܒܝܐ ܐܢܐ ܝܘܡܢܐ ܗܠܝܗܐ ܒܢܒܝܐ ܕܢܬܠܚܢܬܐ ܒܝܬܐ

٨ . ܐܢܐ ܒܗܠܝܢܘܬܐ ܒܗܦܟܐ ܡܘܦܠܚܐ ܥܠ ܝܘܡܢܐ ܗܕܢܐ ܗܘܝ ܒܦܝܫܐ ܕܒܗܠܝܢܘܬܐ ܘܠܦܐ ܢܡܘܣܐ ܒܝܬܐ .

ܫ٢ : ܦܝܫ ܒܝ ܦܠܚܬܐ ܕܠܡܕܒܪܢܐ ܦܠܚܐ ܒܡܕܒܪܢܘܬܐ ܕܡܬܚܡܢܘܬܐ ܢܡ ܦܠܚܬܐ ܕܠܡܕܒܪܢܐ ܦܠܚܐ ܒܡܕܒܪܢܘܬܐ ܒܘܪܟܐ .

ܫ٣ : ܦܝܫ ܒܡܕܒܪܐ ܗܕܢܐ ܠܘ ܦܘܬܐ ܠܟܠ ܡܢ ܦܬܓܡܐ ܕܠܬܚܬ ܘܗܕܟ ܠܦܘܬܐ ܐ. ܦܬܓܡ ܣܘܢܐ ܕܠܐ ܢܫܠܦܬܐ ܒܪܐ ܐܝܬ ܗܡܘܬܘ ܣܝܢܐ .

١ . ܗܐ ܕܠܘܟ ܠܦܐ ܗܡܗܐ ܐܢܐ ܒܘܪܐ ܒܡܕܒܪܢܬܐ ܕܒܢܪܐ ܗܠܐ ܕܒܘܠ ܒܘܪܐ ܕܥܠܝܠܐ ܒܡܕܒܪܢܐ ܗܦܡܐ .

٢ . ܐ. ܒܘܪܢܐ ܠܒܢܬܐ ܕܒܫܢܐ ܗܘܐ ܕܒ ܡܢ ܒܘܪܢܐ ܠܒܢܬܐ ܕܦܪܘܠܐ ܒܘܪܢܐ ܒܡܕܒܪܢܐ ܕܒܫܢܐ ܒܗܘܐ ܕܒ ܡܢ ܒܘܪܢܐ ܒܡܕܒܪܢܐ ܕܦܪܘܠܐ .

٣ . ܐܘܕܢܐ ܕܡܬܚܡܢܬܐ ܕܘܝܗܡܘ . ܠܒܠܠܬܐ ܕܒܘܠܐ ܕܒܘܪܢܐ ܒܡܕܒܪܢܐ ܒܝܬ ܐܘܪܚܐ ܕܡܫܝܚܘܬܐ ܡܢ ܐܘܕܢܐ ܕܒܗܠܝܢܘܬܐ ܘܐܘܡܢܘܬܐ .

٤ . ܒܡܕܢܚܐ ܡܬܩܪܝܢ ܠܡܕܢܚܝܐ ܕܡܕܢܚܐ ܣܒܪ ܥܠ ܕܘܟܬܐ ܕܐܘܪܚܬܐ ܕܡܕܝܢܬܐ ܛܘܪܐ ܣܝܢܝ.

٥ . ܒܐܠܦܘܬܐ ܐܢܫܝܬܐ ܠܡܫܝܚܐ ܕܒܗܬܐ ܕܒ ܡܢ ܚ . ܘ . ܗ ܕܡܫܘܚܬܐ ܒܡܘܬܐ ܕܡܘܬܒܐ ܦܠܛܐ.

٦ . (ܠܐ ٢ ܒܘܠ) ܦܠܛܘ ܡܥܕܐ ܕܡܘܬܒܐ ܒܡܫܢܝܐ ܡܬܘܚܠܦܐ ܠܡܘܬܒܐ ܒܣܘܪܝܝܐ

ܒ٤ : ܡܢ ܝܠܗ ܡܫܘܚܬܐ ܕܟܬܒܐ ܕܐܠܗܘܬܢܝܐ ܒܐܬܘܪܝܐ ܡܫܘܦܝܐ؟

ܒ٥ : ܟܠ ܐܢܐ ܐܢܐ ܦܫܛ ܐܘܪܚܐ ܙܡܪܐ ܐܠܗܘܬܢܝܐ؟

ܒ٦ : ܦܘܪܫ ܒܝܢ ܡܫܝܚܝܐ ܕܢܝܬܐ ܘܠܐ ܕܢܝܬܐ ܓܘ ܙܡܪܐ ܐܠܗܘܬܢܝܐ.

ܒ٧ : ܠܡܢܐ ܗܘܐ ܙܡܪܐ ܐܕܢܝܐ ܠܫܡܐ ܠܡܦܠܚܬܗ ܐܝܟ ܡܕܒܪܢܐ؟

ܒ٨ : ܡܢ ܝܠܗ ܒܫܡܘܬܐ ܕܐܒܝܫܘ؟ ܗܒ ܦܘܫܩܐ ܠܗ.

ܒ٩ : ܡܢ ܝܠܗ ܙܘܥܐ ܕܪܘܚܐ ܕܐܠܗܘܬܢܝܐ ܓܘ ܙܡܪܐ ܐܕܢܝܐ ܡܫܘܦܝܐ؟

ܒ١٠ : ܡܢ ܝܠܗܝ ܓܢܒܪܐ ܕܕܝܢܬܐ ܘܦܘܪܫܢܐ ܒܝܢ ܗܘܓܝܬܐ ܕܡܢܐ ܘܦܠܓܘܬܐ ܐܠܗܘܬܢܝܬܐ ܕܡܫܝܚܘܬܐ؟

ܒ١١ : ܦܫܛ ܕܐܢܝ ܒܗܡܙܠܗ ܦܠܚܝܢ ܒܫܡܘܬܐ ܕܐܒܝܫܘ ܓܘ ܦܘܪܡܐ.

ܒ١٢ : ܡܢ ܝܠܗ ܒܘܪܟܬܐ ܕܝ ܦܘܪܫ ܓܘ ܓܘܢܝܐ ܕܙܡܪܐ ܐܠܗܘܬܢܝܐ؟

ܒ١٣ : ܓܠܝ ܦܘܠܚܢܐ ܕܟܠ ܚܕ ܡܢ ܕܢܝܬܐ ܓܘ ܙܡܪܐ ܐܠܗܘܬܢܝܐ : ܡܫܝܚܝܐ ܡܫܝܚܝܐ . ܡܫܡܫܢܐ . ܒܢܝܐ ܕܥܠܝܬܐ .

ܒ١٤ : ܕܐܢܝ ܒܫܠܗ ܠܦܐ ܓܘ ܙܡܪܐ ܐܕܢܝܐ ܐܢܫ
ܐ . ܒܫܠܗ ܕܕܠܐ ܕܫܡܫܘܬܐ ܕܡܫܝܚܝܐ؟
ܒ . ܒܘܫܠܦܐ ܕܡܘܬܒܐ ܩܘܕܫܐ ܕܡܫܡܫܢܐ

ܒ١٥ : ܕܟܡܐ ܕܝܠܬܐ ܕܝܘܡܢܐ ܕܡܫܝܚܝܐ؟

ܒ١٦ : ܗܝܟܐ ܐܢܐ ܐܢܫܘܬܐ ܐܕܢܝ ܘܕܝܢܐ ܕܡܫܝܚܝܐ؟

ܦܘܫܩܐ ܡܫܪܝܐ ܝܘܠܦ ܟܘܟ̈ܒܐ

Astronomy

ܚܘܪܪܐ

ܒܝܕ ܣܘܟ̈ܠܐ ܝܘܠܦ̈ܢܐ ܘܡܢܝܢܘܬܐ ܠܢܐ
ܦܝܫܝܢ ܠܝܕܘܥ ܠܟܘܢܢܐ ܠܐ ܒܟܢܢܐ ܐܘ
ܒܪܝܘܥܐ ܡܘܬ̈ܪܐ ܘܪܝܘܥܐ ܚܠܝܘܕ
ܐܠܐ ܪܘܚܩܗ ܕܝܘܡ̈ܬܐ ܕܢܒܟܢ
ܡܘܚܐ ܕܛܠܠܐ ܟܘܪܘܡܛܘܓܪܦܝܐ
ܘܡܛܠܬܗ ܢܪܘܚ ܠܛܠܝܬܐ
ܕܒܝܫܘܬܐ ܪܒܐ ܐܝܟ ܟܘܟܒܐ ܚܠܒܝܢܐ
ܘܟܘܝܪܬ ܘܛܠܝܬܐ ܕܒܝܬܪܐ ܠܗ
ܪܡܫܐ ܒܪܐ ܐܦ ܗܘܪܬܗ ܣܓܝܐܐ
ܘܡܟܝܒܐ ܥܠ ܫܡܝܪܬܐ ܕܪܡܫܐ ܒܪܐ
ܘܪܦܬܐ ܕܡܪܟܒܐ ܪܡܫܐ ܡܣܬܒܪܐ
ܡܢܗ ܠܐ ܡܣܬܒܪܐ ܘܫܘܪܐ ܙܢܘܢܬܢܝܐ
ܘܢܛܪܬܐ ܡܢܗ ܠܗ ܕܢܘܗܪܬܐ
ܘܡܙܝܕܬܐ ܕܝܕܥܬܐ ܥܠ ܒܪܝܬܐ
ܘܠܘܣܡܐ ܣܡܝܢܐ ܐܝܟ ܟܘܡܪܗ
ܘܡܢܘܬܗ ܘܛܘܪܗ

١٠ — ١ ܟܘܟܒܐ

١٠ — ٢ ܕܝ̈ܠܝܬܐ ܦܘܪ̈ܫܐ ܕܦܠܢ̈ܛܐ

١٠ — ٣ ܐܣܘܪܐ ܕܫܡܫܐ
ܕܦܠܢ̈ܛܐ ܕܚܕܪ̈ܢܘܗܝ

١٠ — ٤ ܫܘܪ̈ܛܐ ܕܫܒܝܠܘ
ܡܪܝܡ . ܪܫܡ

١٠ — ٥ ܛܘܦܪܐ ܟܘܟ̈ܒܐ

١٠ — ٦ ܟܘܟܒܐ ܢܘܗܪ̈ܢܝܐ

١٠ — ٧ ܒܝܬ ܟܦܡܐ

١٠ — ٨ ܟܘܟܒܐ ܫܪ̈ܝܝܐ

١٠ — ٩ ܐܒܢܬܐ ܕܟܘܟܒܐ
ܫܪ̈ܝܐ ܦܘܪ̈ܫܐ

١٠ — ١٠ ܚܫܘܒܐ ܦܠܢ̈ܛܐ

١٠ — ١١ ܚܪܦܬܐ ܪܡܫܐ

١٠ — ١٢ ܗܘܠܐ ܒܝܢ ܟܘܟ̈ܒܐ

١٠ — ١٣ ܣܘܪܐ

١٠ — ١٤ ܟܡܝܪܬ

١٠ — ١٥ ܡܫܚܬܐ ܕܟܪܝܬܐ ܘܟܢܝܫܘܬܐ ܕܪܝܫܬܐ ܕܐܘܪܚܐ ܕܫܒܝܠܐ

(١٠ — ١) ܟܘܟܒܐ Stars

ܟܘܟܒܐ ܒܫܡܝܐ ܚܙܝܐ ܝܘܡܢ ܠܥܝܢܐ. ܐܠܐ ܐܝܠܗܐ ܕܫܠܝܛܐ ܕܝܘܩܢܘܗ ܡܢ ܥܡܩܐ ܝܠܗ ܒܡܟܣܝܘܗ ܠܒܘܫܐ ܡܢܗ. ܘܐ، ܗܘܐ ܗܘܐ ܒܡܟܣܐ ܕܥܡܩܐ ܗܘܐ ܐܝܟ ܒܡܟܣܐ ܕܟܘܟܒܐ ܒܡܫܘܚܬܐ ܗܘܐ ܥܡܩܐ ܐܝܟ ܢܡܘܣܐ ܒܗܪܟܐ. ܐܠܐ ܒܝܠܝܐ ܕܡܗܪܝܬܐ ܕܪܚܩܐ ܡܢ ܥܡܩܐ ܒܚܘܝܐ ܠܥܡܩܐ ܒܫܡܝܐ ܕܡܪܐ ܠܒܘܫܐ ܒܦܫܘܛܐ ܠܟܘܟܒܐ ܐܚܪܢܐ.

ܟܠ ܟܘܟܒܐ ܗܘܐ ܡܢ ܒܘܩܠܐ ܠܘܩܒܐ ܡܢ ܗܘܦܐ ܘܗܘ ܘܠܝܬ ܒܗܘܪܐ ܦܠܓܐ ܕܦܘܠܓܐ ܢܘܗܪܐ ܕܫܡܫܘܬܐ ܕܪܘܚܝ ܒܟܘܢܘ.

ܦܠܓܝ ܟܘܟܒܐ ܠ :

١ - ܦܪܝܢܐ ܐܝܟ ܥܡܩܐ.

٢ - ܗܪܟܝܐ ܘܥܠܝܐܐ ܐܝܟ ܟܘܟܒܐ ܕܓܘܠܐ.

٣ - ܟܢܘܫܝܐ ܕܟܘܟܒܐ ܐܝܟ ܟܢܘܫܝܐ ܕܟܘܦܐ.

ܘܥܡܘܪܐ ܟܠ ܒܘܥܬܐ ܡܢܗ ܒܕܝܠܬܐ ܕܝܠܗ ܟܘܟܒܐ ܒܪܝܐ ܒܟܪܢܐ ܒܢܬܘ ܘܡܢ ܗܘܠܐ ܒܢܬܘ. ܘܐܡܪܝ ܠܟ ܚܕܪܐ ܒܐܡܪܐ ܕܢܬܘܦܬܐ ܡܬܗܦܟܬܐ.

(١٠ — ٢) ܕܪܓܬܐ ܦܘܫܐ ܕܟܘܟܒܐ

ܡܢ ܙܒܢܐ ܕܐܣܛܪܘܢܘܡܝܐ ܦܠܓܠܗ ܡܦܘܠܓܐ ܟܘܟܒܐ ܡܚܘܝܢܐ ܠܟܪܬܐ ܒܘܥܬܐ ܒܕܪܓܬܐ ܟܠ ܚܕܐ ܕܢܗܝܪܘܬܐ ܕܟܘܟܒܐ. ܘܢܗܝܪܘܬܐ ܕܟܘܟܒܐ . ܝܠܗ ܡܢܝܐ ܙܒܢܐ ܕܗܘܦܐ ܡܚܙܝܢܐ ܡܢ ܟܘܟܒܐ.

ܐܢܐ ܕܪܓܐ ܟܘܟܒܐ ܦܠܓܐ . ܝܠܗ ܡܢܝܐ ܕܟܘܠܐ ܠܘ ܦܪܝܫܐ ܕܢܗܝܪܘܬܐ ܕܟܘܟܒܐ ܐܝܟ ܕܗܘܝ ܟܘܟܒܐ ܚܕܐ ܢܗܝܪܘܬܐ ܒܐ ܬܘܪܐ ܕܪܓܐ. ܘܦܠܓܐ ܕܪܓܐ ܦܠܓܐ (+١) ܕܪܓܐ ܠܟܘܟܒܐ ܚܕܐ ܢܗܝܪܘܬܐ (ܢܗܝܪ ܟܘܟܒܐ) ܘܕܪܓܐ ܦܠܓܐ (+٢) ܕܪܓܐ ܠܟܘܟܒܐ ܕܒܝܬ ܬܪܘܬܐ ܕܢܗܝܪܘܬܐ (ܢܗܝܪ ܟܘܟܒܐ) ܘܟܕܒܐ. ܘܕܪܓܐ ܦܠܓܐ ٦٠ ܕܪܓܐ ܕܟܘܟܒܐ ܦܘܫܐ ܘܠܐ ܝܠܗ ܡܢܝܬܐ ܚܙܝܬܐ ܕܟܘܟܒܐ ܗܕ ܕܪܓܐ ܦܠܓܐ (+٧) ܕܪܓܐ ܒܥܝܢܐ ܦܠܚܐ. ܘܕܪܓܐ ܦܠܓܐ ܕܥܡܩܐ ܝܠܗ (-٢٦،٦) ܕܪܓܐ.

ܐܠܐ ܟܠܗ̈ ܟܘܟܒ̈ܐ ܡܫܢ̈ܝܐ ܟܠܗ̈ ܒܢܘܗܪܐ. ܐܠܘ ܟܘܠܗ ܠܘ ܠܚܕ ܡܫܡܫܢܐ ܕܚܡܝܡܘܬܐ ܕܟܘܟܒܐ ܗܝ. ܦܫܛܠܗ ܡܘܬܒܐ ܥܠ ܚܕ ܟܘܟܒܐ ܡܢ ܦܫܛܠܗ ܠܘܬܐ ١٠ ܦܪܣܝ̈ܐ ܡܘܙܠܓܝ̈ܐ ܐܘ ٣٢.٦ ܫܢܝ̈ ܢܘܗܪܐ، ܗܢܐ ܘܟܝܢ ܟܠܗ ܗܢܐ ܕܟܘܟܒܐ. ܐܠܘ ܟܠܗ ܠܠܡܐ ܕܐܘܐ ܟܘܟܒܐ ܥܠ ܟܘܟܒܐ ١٠ ܦܪܣܝ̈ܐ ܡܘܙܠܓܝ̈ܐ

<u>ܓܠܠ̈ܐ ܕܟܘܟܒ̈ܐ</u>. ܦܫ ܡܘܫܚܢܐ ܠܘܢܐ ܕܢܘܗܪܐ ܦܠܓܘܬܐ ܡܢ ܟܘܟܒܐ ܡܟܘܢܐ ܠܚܡܐ ܠܟܠܗ ܒܕܪܓܐ ܥܠ ܟܘܟܒܐ.

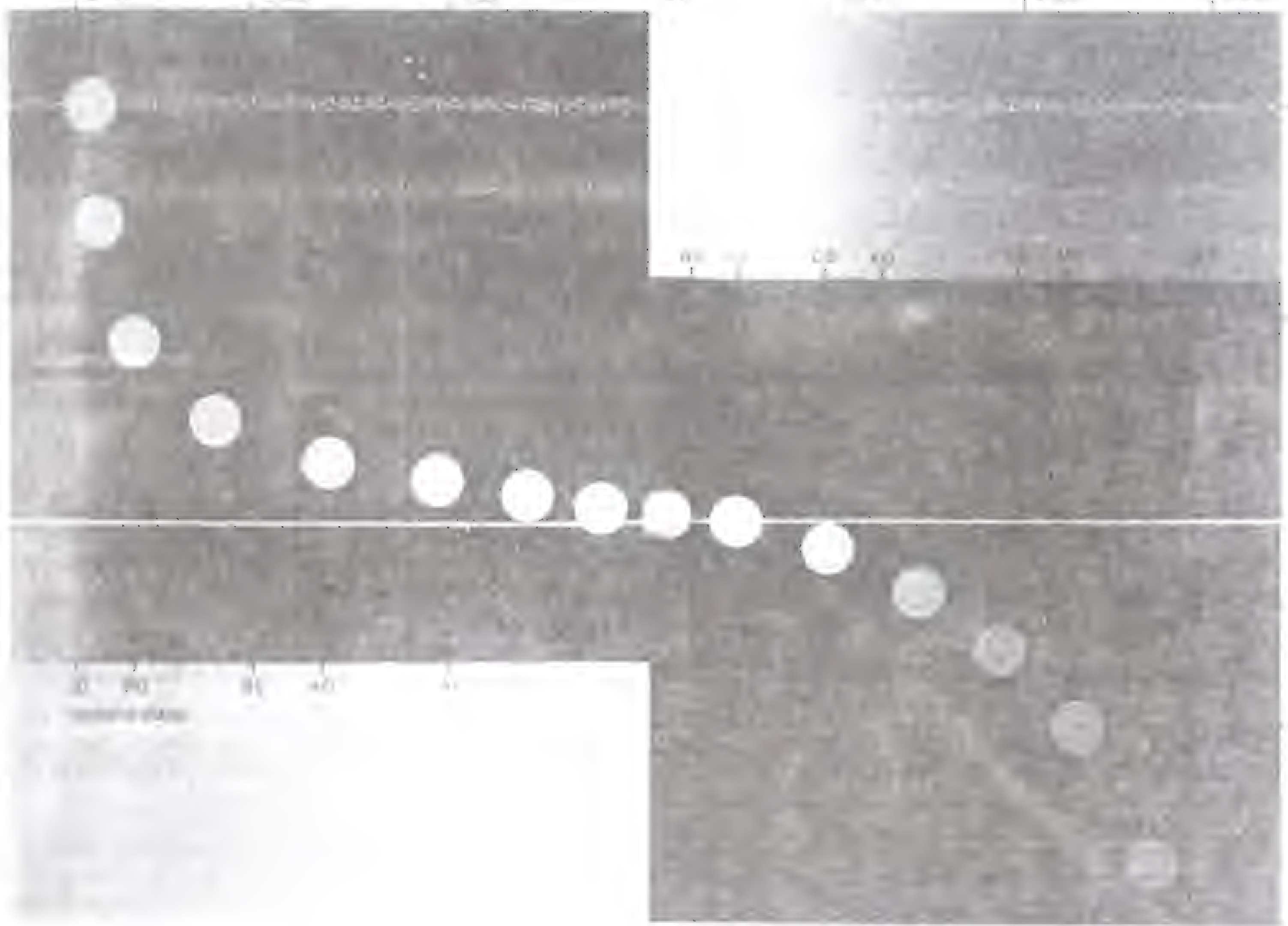
ܘܟܕ ܓܠܠ̈ܐ ܐܠܘ ܫܠܛܐ ܡܢ ܐܬܪܐ ܦܠܓܘܬܐ ܡܢ ܡܟܘܢܐ ܕܟܘܟܒܐ ܕܐܝܟ ܠܘܢܘ ܟܘܕ ܕܐܘܐ ܠܗ ܡܦܠܚܐ ܕܦܩܟܬܘ ܠܐܦ ܡܘܓܠܠܐ ܟܡܢܝܚ ܕܐܝܬ ܐܡܪ ܐܘܡܪܐ ܟܝ ܓܠܠ̈ܐ ܟܘܟܒܐ ܥܠ ܠܘܢܘ.

ܟܘܕ ܕܐܘܐ ܐܘܪܝܢܠܘ ܢܒܘܬܐ ܘܪܩܘܪ ܠܟܘܟܒܐ ܠܡܕܪܐ ܓܠܠ̈ܐ ܟܠܝܢ ܠܩܘܬ ܠܘܢܘ ܘܐܘܪܝܘ ܓܠܠ̈ܐ ܘܦܫܛܠܗ ܡܘܬܒܐ ܣܕܪܐ ܕܓܠܠ̈ܐ ܠܩܘܬ ܟܕܪ̈ܓܐ ܕܕܪ̈ܓܐ ܕܚܡܝܡܘܬܐ ܫܛܚܝܬܐ ܕܟܘܟܒܐ ܕܐܝܟ ܐܘܡܪܐ ܥܠ ܠܘܢܐ ܕܟܘܟܒܐ ܐܝܟ ܟܡܘܪܓܐ ܕܐܬܐ:

ܡܘܪܓܐ ܕܡܢܐ (١) ܡܚܘܐ ܣܕܪܐ ܓܠܠ̈ܐ ܕܟܘܟܒܐ ܠܩܘܬ ܠܘܢܗ ܘܕܪ̈ܓܐ ܕܚܡܝܡܘܬܗ ܫܛܚܝܬܐ

ܣܕܪܐ <u>ܓܠܠ̈ܐ</u>	O	B	A	F	G	K	M
ܓܘܢܐ ܕܟܘܟܒܐ	ܙܪܩܐ	ܙܪܩܐ ܡܚܘܪܐ	ܚܘܪܐ	ܚܘܪܐ ܫܥܘܬܢܝܐ	ܫܥܘܬܐ	ܦܘܬܐ	ܣܘܡܩܐ
ܕܪܓܐ ܕܚܡܝܡܘܬܐ ܫܛܚܝܬܐ	٣٠٠٠٠ <u>ܟܠܒܢ</u>	٢٠٠٠٠ <u>ܟܠܒܢ</u>	١٠٠٠٠ <u>ܟܠܒܢ</u>	٧٠٠٠ <u>ܟܠܒܢ</u>	٥٥٠٠ <u>ܟܠܒܢ</u>	٤٥٠٠ <u>ܟܠܒܢ</u>	٣٠٠٠ <u>ܟܠܒܢ</u>

ܘܦܫ̈ܐ ܡܘܫܚܢܐ ܫܡܝܢܐ ܡܢ ܐܪ̈ܒܥ ܕܣܕܪܐ ܓܠܠ̈ܐ ( ) ܐܝܟ ܕܐܠܘ ܟܠܗ ܒܡܘܪܓܐ (١)



ܨܘܪܬܐ (١٠ - ١)

(١٠ — ٣) ܐܚܝܢܘܬܐ ܕܡܬܩܠܐ ܕܟܘܟܒܐ ܒܢܘܗܪܝܘܬܗ

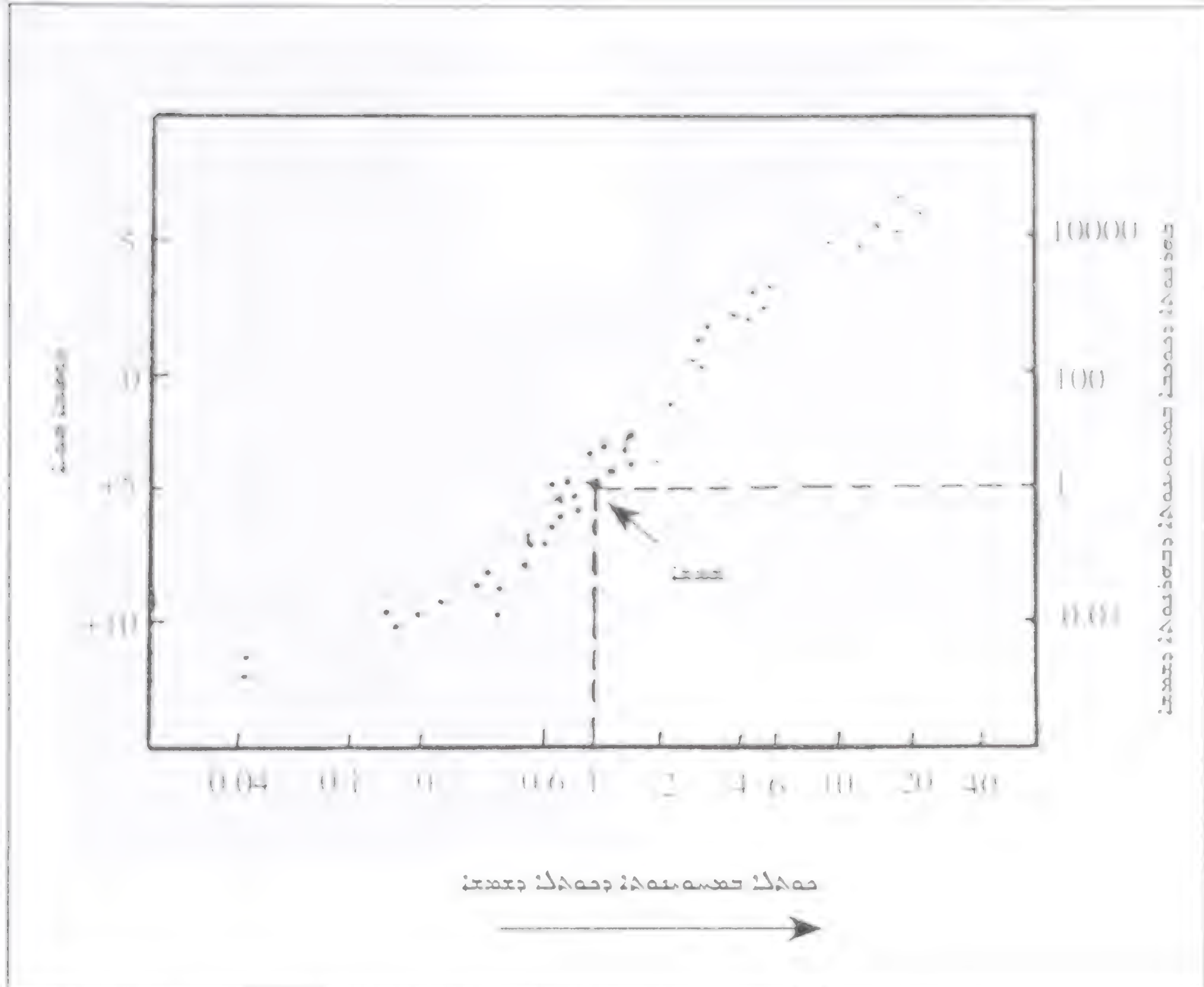
Mass – Luminosity relation

ܡܢ ܒܬܪ ܕܒܨܝܬܐ ܦܠܚܢܐ ܕܟܘܟܒܐ ܦܪܝܣ ܕܐܝܬ ܠܒܕܩܬܐ ܥܠ ܢܘܗܪܝܘܬܐ ܕܟܘܟܒܐ. ܘܫܘܠܡܐ ܗܘܐ ܕܟܘܟܒܐ ܠܐܚܝܢܘܬܐ ܕܡܘܬ ܢܗܝܪܬܐ ܒܝܢ ܠܗ ܠܬܚܘܡܐ ܕܢܘܗܪܝܘܬܐ ܕܐܝܟ ܟܘܟܒܐ ܟܡܝܘܬܐ ܕܢܘܗܪܝܘܬܐ ܕܫܡܫܐ ܥܡ ܡܬܩܠܐ ܕܟܘܟܒܐ ܠܡܬܩܠܐ ܕܫܡܫܐ. ܘܟܘܟܒܐ ܕܡܬܩܠܗ ܥܦܝܦܐ ܕܡܬܩܠܐ ܕܫܡܫܐ ܗܘܝܐ ܢܘܗܪܝܘܬܗ ܝܬܝܪ ܡܢ ܢܘܗܪܝܘܬܐ ܕܫܡܫܐ ܒ (١١) ܙܒܢܐ ܘܠܦܘܬ ܗܕܡܐ ܕܒܕܩܬܐ ܨܘܪܬܐ (٢).

ܘܐܝܬ ܐܚܝܢܘܬܐ ܒܝܠܗ : ܢ $\propto$ ܡ$^{3.5}$

ܟܕ : ܢ = ܢܘܗܪܝܘܬܐ ܕܟܘܟܒܐ (ܡܩܝܣܐ ܒܝܕ ܕܡܘܬܐ ܦܠܚܐ ܡܢ ܕܫܡܫܐ)

ܡ = ܡܬܩܠܐ ܕܟܘܟܒܐ.



ܨܘܪܬܐ (١٠ - ٢) ܐܣܘܪܐ ܕܢܘܗܪܐ ܥܡ ܝܘܩܪܘܬܐ

(١٠ — ٤) ܣܘܪܛܐ ܕܗܪܬܙ ܫܦܪܘܢܓ - ܪܘܣܠ (H-R)

ܒܫܢܬܐ ܡܕܡܝܐ ܕܐܗܐ ܕܪܐ ܡܫܟܚܠܗ ܬܪܘܨܐ ܗܪܬܙ ܘܬܪܘܨܐ ܗܢܪܝ ܪܘܣܠ ܟܠܚܕ ܠܚܘܕܗ ܗܘܝܬܐ ܕܐܣܘܪܐ ܕܟܘܪܗܢܘܬܐ ܕܟܘܟܒܐ ܥܡ ܡܕܪܝܗ ܛܝܦܐ ܐܘ ܓܘܢܐ ܕܟܘܟܒܐ (ܕܐܝܬ ܥܠ ܕܪܓܐ ܕܫܚܝܢܘܬܐ ܕܓܠܝܐ ܕܟܘܟܒܐ).

ܘܫܘܚܬܐ ܗܠܝܢ ܠܡܣܬܟܠܘܬܐ ܕܗܕܟܐ (ܒܢܝܐ ܕܐܝܟ ܗܕܟܐ ܦܠܛܐ ܡܢ ܟܘܟܒܐ ܗܢܐ ܘܡܢ ܟܘܪܗܢܘܬܗ) ܐܝܟܢܐ ܥܠ ܫܚܝܢܘܬܐ ܫܚܝܢܘܬܐ ܕܟܘܟܒܐ. ܐܦ ܐܝܟܢܐ ܥܠ ܕܪܓܐ ܕܫܚܝܢܘܬܐ ܫܚܝܢܘܬܐ ܕܟܘܟܒܐ ܒܢܝܗ. ܒܗܘ ܕܐܗܐ ܒܚܝܪ ܕܐܝܬ ܐܝܟ ܟܘܟܒܐ ܕܪܓܐ ܕܫܚܝܢܘܬܗ ܫܚܝܢܬܐ ܪܒܬܐ ܘܗܕ ܟܘܪܗܢܘܬܐ ܚܠܝܬܐ ܦܝܫ ܡܕܝܢ ܟܟܘܟܒܐ ܟܠܝܢ ܫܚܝܢܘܬܗ ܫܚܝܢܬܐ ܐܢ ܒܠܚܘܕ ܕܐܬܐ ܡܢ ܫܚܝܢܘܬܐ ܕܢܦܫܗ)).

ܘܠܗ ܕܪܓܐ ܕܗܘܪܛܐ ܕܗܪܬܙ ܪܘܣܠ ܒܚܝܪ ܕܟܘܟܒܐ ܡܦܠܓܝܢ ܠܗܘܢ ܠܬܠܬܐ ܟܢܘܫܝܐ ܐܝܟ ܕܗܘ ܓܠܝܐ ܒܨܘܪܬܐ (٣).

١ - ܣܘܼܪܓܵܐ ܕܟܵܘܟܒܹ̈ܐ ܓܢܵܒܪ̈ܐ ܗܡܵܘܢܹܐ (The Giant Stars)

ܐܝܼܠܗܝ ܟܵܘܟܒܹ̈ܐ ܟܘܼܠܗܘܢ ܟܡܵܐ ܐܘ ܕܪ ܟܡܠܠ ܡܢ ܟܘܟܒܐ ܕܫܡܫܐ ܐܠܐ ܟܡܐ ܟܒܝܪܝܗ ܠܟܘܪܐ ܪܒܐ ܘܣܓܝܐܘܬܗ ܢܘܗܪܐ ܘܟܢܘܫܝܘܬܗ ܒܠܚܘܕ. ܐܠܐ ܕܪܓܐ ܕܫܚܝܢܘܬܗ ܟܝ ܢܘܗܪܐ ܕܫܚܝܢܘܬܐ ܡܢ ܫܡܫܐ. ܘܗܘܐ ܓܘܢܗ ܗܡܘܢܐ ܐܘ ܡܫܡܫܢܐ ܘܢܦܠܝ ܠܟܠ ܕܗܘܢܓܐ ܘܟܠ ܙܘܓܐ ܫܡܫܢܐ ܡܢ ܣܕܪܐ. ܓܠܠܐ (K.M) ܘܠܐ ܢܠܡܝ ܠܐܝܢܘܬܐ ܕܟܘܟܒܐ ܢܡ ܟܢܘܫܝܘܬܐ.

٢ - ܣܘܼܪܓܵܐ ܕܟܵܘܟܒܹ̈ܐ ܫܪܫܬܵܐ ܪܹܫܵܝܬܵܐ (Main Sequence Stars)

ܘܓܘܫܢܐ ܣܓܝܐܐ ܕܟܘܟܒܐ ܣܘܪܐ ܘܫܡܫܐ ܘܐܝܠܝܗ ܡܢ ܓܘ ܕܐܘܪܐ ܕܐܘܪܐ ܣܘܪܓܐ ܟܘܟܒܝܐ ܘܠܡܘܕܟܢܘܬܗ ܡܓܠܝܗ ܢܘܗܪܐ ܡܢ ܦܫܛܐ ܕܫܚܝܢܘܬܐ ܟܪ ܪܒܐ ܡܢ ܕܠܬܗ. ܘܠܕܐܘܪܐ ܦܠܓܘ ܣܢܝܕܐ ܫܡܫܐ ܟܘܟܒܐ ܡܫܘܚܬܐ ܟܡܫܘܚܬܗ ܢܒܝܫ ܥܠ ܕܠܬܐ ܕܟܘܟܒܐ ܐܚܪܢܐ ܐܝܟ ܟܘܟܒܐ ܕܟܢܘܫܝܘܬܐ. ܦܠܓܐ ܕܡܓܪܗ ܘܕܪܓܐ ܕܫܚܝܢܘܬܗ ܟܡܝܚܬܐ. ܘܟܘܟܒܐ ܕܢܦܠܝ ܠܟܠ ܗܘܢܓܐ ܘܟܙܘܓܐ ܡܫܠܐ ܗܘ ܟܡܝܐ ܘܡܪ ܟܢܘܫܝܘܬܐ ܒܠܚܘܕ. ܘܓܘܢܗ ܟܡ ܙܪܩܐ ܘܣܘܡܩܐ ܘܡܢܕܪܝܗ ܓܠܠܐ (O B).

ܐܨܘܼܪܬܵܐ (١٠ - ٣) ܗܘܼܠܵܕܵܐ ܕܗܹܪܬܣܝ ܫܦܪܘܿܢܓ - ܪܵܣܸܠ

ܘܟܘܨܠܝܗ ܠܟܘܪܐ ܕܒ ܡܢ ܟܘܨܠܐ ܕܫܡܫܐ ܒ (٥٠) ܠܗܘܐ ܘܦܝܫܝ ܡܕܝܐ ܒܫܠܝܡܐ ܘܕܡܐ ܘܐܦ ܚܠܕܝܗ ܠܟܘܪܐ ܕܒܐ ܠܝܗ ܐܠܐ ܟܘܟܒܐ ܕܢܦܠܝ ܒܐܠܗܝܗ ܕܡܘܪܙܐ ܘܬܘܪܒܐ ܡܫܢܝܐ ܠܝܗ ܡܕܝܕܐ ܕܒܐ ܘܒܘܪܝܘܬܗ ܬܘܪܕܐ ܘܟܘܨܠܝܗ ܘܟܘܪܐ. ܘܠܝܗ ܒܪ ܬܘܪܐ ܡܢ ܟܘܨܠܐ ܕܫܡܫܐ ܒ (١٠) ܠܗܘܐ ܘܚܠܕܝܗ ܘܟܘܪܐ ܘܦܝܫܝ ܡܕܝܐ ܒܡܘܙܐ ܚܡܘܡܐ. ܘܟܘܟܒܐ ܕܠܗ ܡܙܓܐ ܕܟܢܘܫܬܐ ܠܝܗ ܟܘܟܒܐ ܙܘܦܢܐ ܕܡܢ ܠܫܡܫܐ ܒܕܠܝܗܝܗ.

ܐܢܫܐ ܕܡܐ ܕܫܡܫܐ ܒܘ ܐܘܐ ܟܢܘܫܬܐ ܬܠܡܝ ܠܐܣܢܘܬܐ ܕܟܘܨܠܐ ܕܟܘܟܒܐ ܠܒ ܒܘܪܝܘܬܗ ܘܒܣܘܝܐ ܕܟܘܟܒܐ ܒܫܠܝܡܐ ܘܕܡܐ ܗܘܝ ܒܘܪܝܘܬܗ ܘܟܘܨܠܝܗ ܠܟܘܪܐ ܘܡܘܙܐ ܚܡܘܡܐ ܒܘܪܝܘܬܗ ܘܟܘܨܠܝܗ ܘܟܘܪܐ.

٣ ـ ܟܢܘܫܬܐ ܕܟܘܟܒܐ ܡܘܙܓܐ ܚܘܪܐ (White Dwarf Stars)

ܢܦܠܐ ܐܘܐ ܟܢܘܫܬܐ ܒܦܘܡܐ ܦܣܩܐ ܕܙܘܦܢܐ ܗܦܠܬܐ ܘܠܝܗ ܡܢ ܗܕܪܐ ܦܠܠܬܐ (O.A.B) ܟܡܕ ܕܐܘܐ ܗܘܝ ܟܘܟܒܐ ܬܣܝܢܐ ܕܒܐ ܘܦܘܢܝܗ ܘܕܡܐ ܐܘ ܚܘܪܐ ܐܠܐ ܒܘܪܝܘܬܗ ܬܘܪܕܐ ܠܟܘܪܘܬܐ ܕܚܠܕܝܗ ܒܦܘܫܩܐ ܒܚܠܕܐ ܕܫܡܫܐ. ܐܠܐ ܡܙܓܐ ܕܟܘܨܠܝܗ ܦܝܠ ܟܘܨܠܐ ܕܫܡܫܐ ܐܠܐ ܒܣܝܘܬܐ ܚܠܝܬܐ ܕܒܐ. ܘܐܘܐ ܟܢܘܫܬܐ ܠܐ ܬܠܡܐ ܠܐܣܢܘܬܐ ܕܟܘܨܠܐ ܠܒ ܒܘܪܝܘܬܐ.

(١٠ ـ ٥) ܫܘܘܕܐ ܕܟܘܟܒܐ (Stellar Evolution)

ܬܪܝ ܟܘܟܒܐ ܘܚܠܕܝ ܒܡܫܡܠܐ ܘܕܢܝܐ ܕܒܐ ܬܪܬܐ ܒܒܕܝܬܐ ܡܢ ܬܠܝܘܬܐ ܒܡ ܡܫܡܠܐ ܕܦܘܠܘܬܐ. ܘܦܪܘܩ ܒܡܫܡܠܐ ܕܡܘܬܐ (ܗܠܣܬܐ).

ܐ. ܠܘܫܡܠܐ ܠܟܘܟܒܐ ܡܗܣܟܐ ܒܫܡܫܐ ܘܡܢܠܐ ܠܫܡܝ. ܚܠܘ ܬܪܬ ܣܕܟܡܐ ܫܢܐ ܐܘ ܐܦ ܬܪܬ ܚܡܪܐ ܕܫܢܐ ܠܐ ܣܘܣ ܐܦܣܕ ܒܘܣܠܦܐ. ܘܚܕܪܐ ܚܠܬܐ ܒܐܘܐ ܠܒܘܪܬܐ ܕܣܘܬܐ ܕܟܘܟܒܐ ܢܕܝܒܬܐ ܕܡܒܣܐ ܗܘܝ ܡܢܩܣܐ ܒܡ ܦܠܘܬܐ ܠܟܠܘܬܐ ܕܫܢܐ. ܡܐ ܕܚܫܡ ܚܠܐ ܕܕܫܬܐ ܕܡܫܡܠܐ ܕܦܘܪܣܝܗ ܒܢܕ ܕܦܘܡܘܬܐ ܐܘ ܒܟܢܐ ܬܠܣܘܕ ܐܦ ܫܡܫܐ ܒܣܘܣܠܘ ܐܕܦܘܡ ܬܐܝܢܘܬܐ ܕܬܠܘܬܐ ܡܢ ܒܕ ܟܘܨܠܘ ܘܚܠܕܘ ܘܒܘܪܝܘܬܗ ܘܐ. ܕܟܕܣ ܠܐܡܝܐ ܐܘ ܐܠܦܐ ܕܫܢܐ ܡܢ ܘܟܢܡ

ܕܩܵܐܡ ܠܵܐ ܚܘܵܣ ܐܲܦܸܣ ܒܡܲܫܠܦܵܐ. ܐܸܠܵܐ ܡܸܕܸܡ ܡܲܫܠܡܵܢܵܐ ܐܵܘ ܟܠܡܵܢܵܐ ܕܟܸܢܹܐ ܒܣܘܼܣ
ܒܡܲܫܠܦܵܐ ܠܟܘܼܦܪܵܐ ܟܠܵܗ ܡܸܢ ܡܵܐ ܕܝܠܵܗ ܟܠܵܗ ܗܵܘܵܐ.

ܡܵܐ ܕܡܸܫܚܵܐ ܕܒܘܼܪܵܟܵܐ ܕܚܲܝܘܼܬܵܐ ܕܟܘܼܟ݂ܒܹ̈ܐ ܢܵܦܸܩܵܐ ܝܠܵܗ ܪܵܒܵܐ. ܐܸܠܵܐ ܒܕܪܵܓܵܐ
ܕܐܲܚܪܵܝܬܵܐ ܦܘܼܫܵܐ ܘܡܘܼܬܘܼܪܹܗ ܘܐܸܬ݂ܪܵܝܵܐ ܟܒܝܼܪ ܦܠܓܵܐ ܕܟܡܘܼܡܘܼܬܵܐ ܕܡܲܘܬܵܐ
ܘܟܲܪܝܼܟܘܼܬܵܐ ܟܠ ܗܘܼܠܵܐ ܕܕܵܪܵܐ ܗܲܕܵܟ݂ ܕܥܠ ܠܟܘܼܦܪܵܐ ܕܟܘܼܟ݂ܒܹ̈ܐ ܒܚܲܝܹ̈ܐ
ܕܪܵܓܵܐ ܕܚܲܝܘܼܬܵܐ ܕܟܘܼܟ݂ܒܵܐ ܘܟܲܪܝܼܟܘܼܬܵܐ ܠܵܐ ܕܪܵܓܵܐ ܚܲܝܘܼܬܹܗ ܒܟܲܪܟܵܐ ܕܐܵܝܟ݂
ܒܗܘܼܢ ܒܟܲܪܟܵܐ.

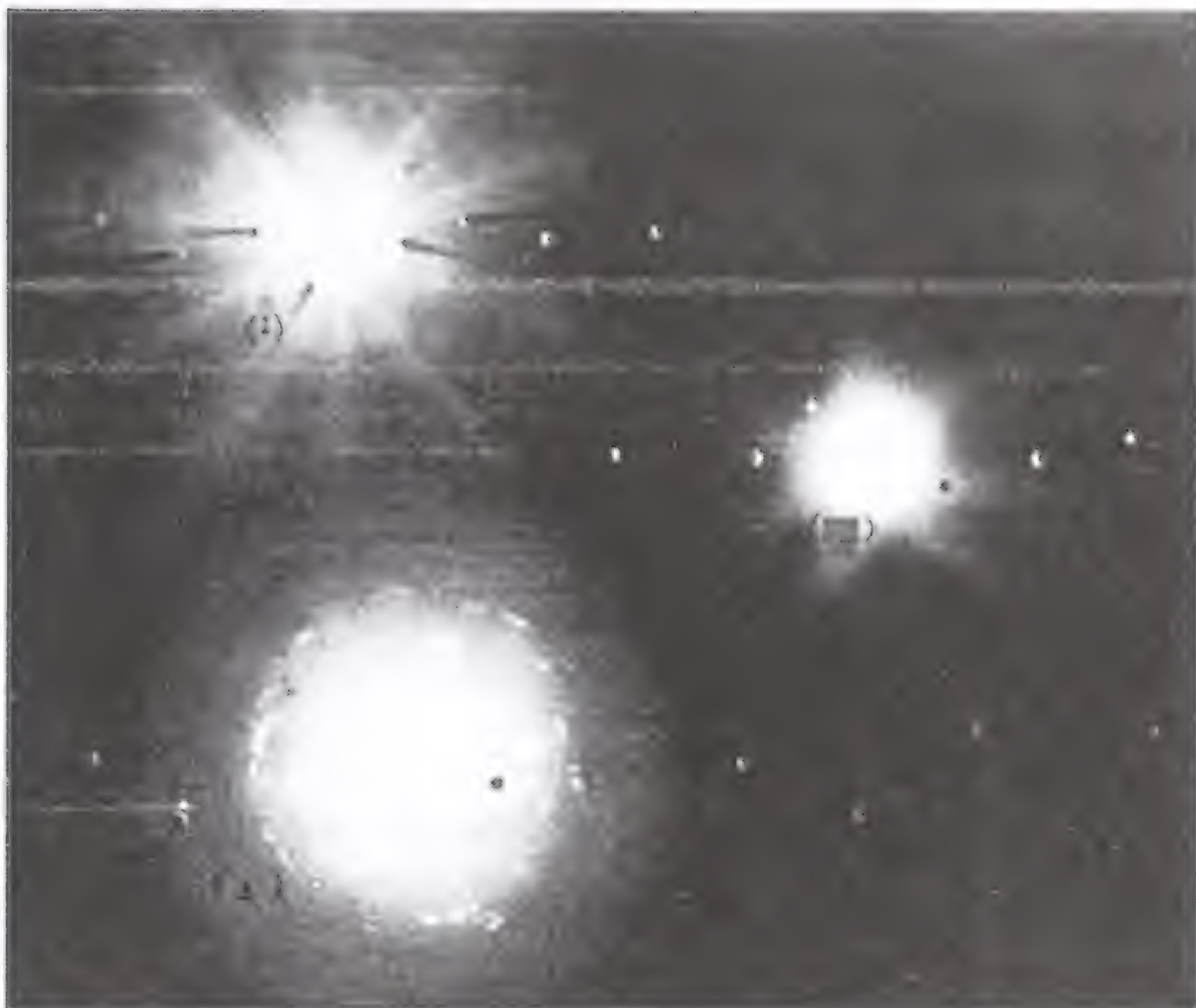
ܗܘܵܐ ܕܟܘܼܦܪܵܢܘܼܬܵܐ. ܟܠ ܟܘܼܟ݂ܒܵܐ ܐܝܼܬ ܡܸܢ ܕܪ̈ܓܹܐ ܕܚܲܝܘܼܬܹܗ ܓܲܠܝܵܐ
ܕܟܵܠܹܐ ܟܠ ܓܵܘܹܗ ܘܐܵܦ ܡܸܢ ܟܘܼܠܗܹܝ ܘܐܲܚܪܵܝܬܹܗ ܟܸܒ ܟܘܼܪܵܗܵܐ
ܘܡܲܘܬܵܐ.

ܗܲܝܡܵܐ ܝܠܵܗ ܠܡܸܬܚܲܙܝܵܐ ܕܟܘܼܟ݂ܒܵܐ ܡܸܢ ܟܘܼܠܵܐ ܠܟܘܼܦܪܵܐ ܐܲܟ݂ܠܹܗ ܕܟܘܼܪܵܐ
ܕܚܲܝܘܼܬܵܐ ܒܟܲܪܟܵܐ ܡܸܢ ܟܘܼܟ݂ܒܵܐ ܡܸܢ ܟܘܼܠܵܐ ܘܟܘܼܦܪܵܐ. ܘܟܠܵܐ ܒܗܵܘܵܐ ܕܟܲܪܵܐ
ܠܣܸܠܵܐ ܕܢܘܼܦܵܐ ܓܘܼ ܟܘܼܟ݂ܒܵܐ ܡܸܢ ܟܘܼܠܵܐ ܠܟܘܼܦܪܵܐ ܡܵܐ ܕܡܸܛܝܵܐ ܕܫܸܡܫܵܐ ܕܕܵܪܵܐ
ܕܫܸܡܫܘܼܬܵܐ ܒܡܠܘܼܠܘܼܬܵܐ ܘܒܐܵܗܵܐ ܗܘܼܝܵܐ ܗܘܼܕܵܪܵܐ ܕܣܝܼܓ݂ܵܐ ܢܘܼܗܪܵܐ
ܘܦܘܼܟܵܠܵܐ ܓܘܼܢܵܐ ܒܝܼ ܡܠܘܼܠܵܐ ܡܸܢ ܡܵܐ ܝܠܹܗ ܟܠܹܗ ܓܘܼ ܟܘܼܟ݂ܒܵܐ ܡܸܢ ܟܘܼܠܵܐ
ܘܟܘܼܦܪܵܐ.

ܒܵܬܲܪ ܕܕܵܪܵܐ ܕܚܲܝܘܼܬܵܐ ܕܟܘܼܟ݂ܒܵܐ ܡܸܢ ܦܲܪܟܵܐ ܕܟܘܼܠܵܐ ܗܘܼܦܵܐ ܘܡܲܦܩܵܐ
ܒܪܵܝܬܵܐ ܕܦܲܪܟܵܐ ܟܡܘܼܪܵܐ ܚܕܵܐ ܡܸܢܕܸܪܵܐ ܘܟܲܪܟܵܐ ܕܠܵܐ ܒܵܠܘܼܬܵܐ
ܕܚܘܼܪܵܢܹܗ ܣܘܼܣܵܐ ܡܲܢܵܝܵܐ ܘܟܲܡܟܸܡ ܦܠܓܵܐ ܕܢܘܼܦܘܼܦܵܐ ܢܘܼܗܪܵܐ ܓܘܼܢܹܗ
ܘܐܲܕܢܝ ܟܘܼܟ݂ܒܵܐ ܡܕܡܝܵܐ ܘܐܝܼܟ݂ܢܵܐ ܕܟܒܝܼܪܵܐ ܗܘܼܦܵܐ ܐܝܼܟ ܕܝܠܹܗ ܓܲܠܝܵܐ ܒܐܝܼܟ݂ܢܵܐ Prto Star

ܒܐܝܼܟ݂ܢܵܐ (٤ - ٢). ܘܟܘܼܢܵܐ ܕܚܘܼܪܵܢܹܗ ܘܡܲܢܵܝܵܐ ܕܟܠܵܐ ܕܝܼܠܹܗ ܘܝܼܕ ܟܘܼܦܵܐ
ܕܢܘܼܦܘܼܦܵܐ ܙܘܼܥ ܡܲܢܕܸܪܵܐ. ܒܡܲܟ݂ܡܵܐ ܕܐܗܵܐ ܡܵܐ ܕܡܸܛܝܵܐ ܠܕܫܸܡܫܵܐ ܕܕܵܪܵܐ
ܕܫܸܡܫܘܼܬܵܐ ܒܡܲܢܕܸܪܵܐ. ܟܘܼܟ݂ܒܹ̈ܐ ܡܕܡܝܵܐ ܡܸܢ ܐܝܼܟ (٣٠٠) ܠܡܠܝܘܿܢ. ܕܕܵܪܵܐ
ܚܲܠܝܵܐ ܕܫܸܡܫܘܼܬܵܐ.

ܗܵܕܵܐ ܒܵܬܲܪ ܦܘܼܟܵܠܵܐ ܢܘܼܗܪܵܐ ܫܸܡܫܘܼܬܵܢܵܐ ܓܘܼ ܡܲܢܕܸܪܵܐ. ܡܵܐ ܕܡܸܛܝܵܐ
ܠܦܠܓܵܐ ܕܕܘܼܪܵܐ. ܘܐܗܵܐ ܗܘܼܟܠܹܗ ܝܠܹܗ ܦܲܪܟܹܗ ܟܘܼܟ݂ܒܵܐ ܓܘܼܦܵܢܵܐ ܐܝܼܟ
ܒܐܝܼܟ݂ܢܵܐ (٤ - ܒ).



ܨܘܪܬܐ (١٠ - ٤) ܡܢܝܢܐ ܕܓܘܦܐ ܕܟܘܟܒ̈ܐ

ܟܘܟܒ̈ܐ ܕܡܬܚܙܝܢ ܠܐܝܟ ܡܢܝܢܐ ܡܢ ܓܘܦܐ ܟܘܟܒ̈ܐ ܩܪܝܒ ܗܢ̈ܐ ܒܡܢܝܢܐ ܕܟܘܟܒ̈ܐ ܕܢܗܝܪܘܬܐ ܪܒܬܐ ܕܡܫܪܐ. ܐܝܟ ܚܕܐ ܡܢ ܟܘܟܒ̈ܐ ܘܠܩܘܒܠ ܟܘܟܒܐ ܕܟܘܟܒ̈ܐ ܒܬܚܝܬ ܒܥܒܝܘܬܗ ܒ ܥܘܦܐ ܒܬܘܪܓܡ ܕܥܕܡ ܡܬܪܝܢ ܪܒܐ. ܘܒܝܢ̈ܐ ܡܢܝܢܐ ܒܚܠܩ ܥܘܦܐ ܕܥܕܡܬܓܒ ܠܥܠܡܐ ܦܠܓܐ ܕܗܘܡܪܢܘܬܐ ܕܬܓܒܬܐ ܢܗܝܪܬܐ ܒܟܘܦܐ ܕܟܘܟܒ̈ܐ ܕܡܪܒܐ ܚܠܐ ܕܚܠܘܙܐ ܘܓܢ̈ܬܐ ܙܥܘܪ ܠܒܪ ܬܘܐ ܚܠܐ ܕܢܗܦܐ ܙܥܘܪ ܓܘܐ ܘܗܘܐ ܟܘܟܒܐ ܗܢ̈ܐ ܒܡܢܝܢܐ ܕܒܠܘܬܐ. ܒܡ ܡܪܒܒ ܡܠܝܘܢܐ ܐܘ ܒܠܝܘܢܐ ܕܫܢܐ ܒܐܝܟ ܡܢܝܢܐ. ܐܠܐ ܒܢܚܠܦܬܐ ܕܗܘܓܢܐ ܕܥܕܡܬܓܒ ܒܡܬܓܒܪܘܢ ܕܟܘܟܒ̈ܐ ܠܥܠܡܐ. ܐܝܟܢܐ ܗܘܡܪܢܘܬܐ ܕܡܬܝܬܐ ܒܡܬܓܒܪܘܢ ܒܡܠܘܠܘܬܐ ܐܠܐ ܬܪܐ ܡܠܦܐ ܥܘܦܐ ܬܪ̈ܝܢ ܒܡܫܚܬܐ ܥܠ ܕܦܫܛ ܟܘܟܒܐ ܡܢ ܟܘܟܒܐ ܒܡܠܝܢܐ ܗܡܘܡܐ. ܘܝܕܥܐ ܬܓܚܘܬܐ ܕܟܘܟܒܐ ܘܐܝܟ ܡܪܒܒ ܠܝܕܥܐ ܕܒܥܪܝܘܬܗ ܐܠܐ ܒܝܪܒ ܕܪܓܐ ܕܫܡܫܘܬܐ ܘܝܕܥܐ ܒܥܪܝܘܬܐ ܐܝܟ ܐܝܟܢܐ ܠܥܘܪܐ ٣٠٠ ܡܠܝܘܢܐ ܫܢܐ ܐܝܟ ܒܨܘܪܬܐ (٤ - ܒ) ܒܡ ܬܪܐ ܡܢܝܢܐ ܕܡܝܬܐ ܕܥܠܡܐ ܘܡܬܚܠܦܐ ܠܒܪܝܐ. ܘܝܕܥܐ ܥܒܕܐ ܒܪܓܐ ܕܫܡܫܘܬܐ ܘܡܪܥܝܒ ܗܘܡܪܢܘܬܐ ܕܡܝܬܐ ܠܗܕܐ ܕܩܡܠܬܐ ܕܟܘܟܒܐ

ܐܢ̈ܫܘܬܐ ܕܒܪܝܬܐ ܕܦܫܝܛܬܐ ܟܡܝܪܬܐ ܟܘܟ̈ܒܐ ܡܟܒܒ ܢܘܗܠܦܐ ܠܠܫܢܐ ܠܟܘܟܒܐ ܐܚܪܐ ܕܡܬܩܠܐ ܡܠܦܐ ܗܘܦܐ ܟܪܝܐ ܗܘܝܘ ܠܟܠܟܪܐ ܘܟܘܪܐ ܪܟܐ ܣܓܝܐܐ ܟܠ ܗܘ ܚܕܐ ܕܗܘܠܐ ܢܗܘܪܐ ܕܦܝܘܝ ܗܠ ܕܦܝܪ ܗܘܚܐ ܣܘܪܐ ܘܐܘܐ ܡܫܡܠܐ ܠܗ ܡܢ ܡܫܡܠܐ ܕܐܠܫܐ. ܗܘܝܐ ܡܢ ܟܘܟܒܐ ܠܦܘܬ ܟܘܬܠܗ ܟܪܒܐ ܟܝܪ ܕܐܘ ܟܡܫܡܠܐ ܕܟܘܟ̈ܒܐ ܢܝܘܛܪܘܢܝܐ ܘܗܘܝܐ ܐܣܪܐ ܡܚܕܐ ܠܡܫܡܠܐ ܕܟܘܟܒܐ ܟܘܡܐ ܐܘ ܢܘܩܒܐ ܐܘܟܡܐ. ܦܠܓܐ ܕܐܡܝܢܘܬܐ ܕܡܢܝܘܬܐ ܟܟܠܟܐ ܠܡܢܝܬܐ ܕܢܝܘܦܘܬܐ ܡܬܪܘܢܝܬܐ ܘܪܡܝܬܐ ܕܪܕܝܐ ܕܡܫܡܫܘܬܗ.

(١٠ — ٦) ܟܘܟ̈ܒܐ ܢܝܘܛܪܘܢܝܐ (Neutron Stars)

ܐܢܘ ܕܪܝܫܬܐ ܕܐܘܪܣܝܐ ܕܗܘܠܦ ܟܘܟܒܐ ܦܫܠܗ ܚܘܬܐ ܕܟܡܐ ܗܘܐ ܟܘܬܠܐ ܕܟܘܟ̈ܒܐ ܟܝܪ ܪܟܐ ܟܡܝܘ ܦܠܓܐ ܕܡܬܪܘ ܠܘܬܘܪ ܗܢܐ ܘܕܡ ܠܗ ܟܡܫܡܠܐ ܕܡܬܬܐ ܕܟܘܟ̈ܒܐ ܠܗܘܚܐ ܣܘܪܐ ܘܐܡܪܐ ܗܘܟܪܝܘܬܐ ܕܡܢܝܘܬܐ ܘܟܡܫܬܐ ܠܡܝܬܐ ܕܢܝܘܦܘܬܐ ܡܬܪܘܢܝܬܐ. ܘܟܘܟ̈ܒܐ ܕܟܘܬܠܗ (١.٤) ܐܝܟ ܬܪܬܐ ܪܟ ܡܢ ܟܘܬܠܐ ܕܫܡܫܐ ܬܐܡܪܐ ܡܢܘܬܐ ܐܢܘ. ܐܚܪܐ ܕܢܝܬܐ ܕܡܠܘܢܐ ܡܘܠܕ ܡܪܝܢܬܐ ܕܐܘܡܘܢܐ ܢܬܪܐ ܗܠ ܕܣܝܕܝ ܐܠܟܬܪܘܢܐ ܝܬܝܪܐ ܘܠܦܡܝ ܐܝܟ ܦܪܘܬܘܢܐ ܝܕܐ ܘܡܫܠܦ ܠܢܝܘܬܪܘܢܐ. ܘܪܐܘܐ ܡܫܡܠܐ ܡܬܚܐ ܣܓܘܬܐ ܠܟܠܗܘܢܐ ܕܚܕܐ ܠܟܠ ܗܡ ٣ ܘܦܠܓܐ ܕܡܬܪܘ ܡܢ (١٠ - ٢٠) ܟܡ ܘܦܝܪ ܡܕܢܐ ܐܘܐ ܟܘܟ̈ܒܐ (ܟܘܟ̈ܒܐ ܢܝܘܛܪܘܢܝܐ) ܕܡܠܘܠܘܬܐ ܕܪܕܝܬܐ ܡܢ ܝܬܝܪܘ ـــــ ܡܠܘܠܘܬܐ ܕܚܘܪܐ.

(١٠ — ٧) ܢܘܩܒܐ ܐܘܟܡܐ (Black Hole)

ܐܢ ܟܘܟܒܐ ܗܘܐ ܡܪ ܟܘܬܠܐ ܐܝܟ ܬܪܬܐ (ܪܟ ܡܢ ܬܠܬܐ ܟܘܬܠܐ ܫܡܫܝܐ) ܠܐ ܡܨܐ ܡܫܕܝ ܕܡܫܠܐ ܡܢܘܬܐ ܘܡܫܬܚܬܐ ܠܠܝܬܐ ܕܡܫܟܚ ܡܢܗ ܟܘܟܒܐ ܐܟܠ ܟܝܬܗ ܘܡܫܬܢܝܘܬܐ ܠܠܝܬܐ ܐܝܟ ܣܠܩܐ ܐܘ ܟܪܝܐ ܡܬܚܐ ܡܢ ܟܘܪܐ ܐܚܪܐ ܕܗܘܐ ܡܠܝܐ ܠܡܪܬܐ ܕܟܘܟ̈ܒܐ ܦܪܡܐ ܡܪ ܟܘܬܠܐ ܐܝܟ ܬܪܬܐ ܪܟܐ ܕܟܠܗ ܕܪܡܘܟܠ ܣܠܩܐ ܕܢܝܘܦܘܬܗ ܡܬܪܘܢܝܬܐ. ܘܗܘܝܘ ܐܡܪܐ ܡܢܘܬܐ ܘܡܫܬܚܬܐ ܗܠ ܕܐܠܝܣ ܟܘܟ̈ܒܐ. ܘܡܬܠܗ ܡܢ ܟܪܝܬܐ ܘܠܐ ܦܝܪ ܡܢܗ ܢܚܘܡ ܡܢ ܢܘܩܒܐ ܐܘܟܡܐ.

ܒܛܘܦܣܐ ܕܝܠܕܐ ܟܘܟܒܐ ܒܟܘܢ ܡܢ ܚܒܠܐ ܐܝܟܐ ܕܠܐ ܗܘܐ ܐܦܝܫ ܡܩܘܪܐ ܓܡܝܪܬܐ ܐܦ ܒܗܕܐ ܕܥܕܢܐ ܡܝܬ ܒܗ. ܘܠܘܠܘܬܐ ܕܥܘܒܕܐ ܡܢ ܡܬܚܝܬ ܒܗܘܢܐ ܘܠܘܠܘܬܐ ܕܒܗܕܐ ܘܐܝܬ ܒܝܬܐ ܟܘܟܒܐ ܠܝܗ ܗܘܐ ܕܟܘܟܒܐ ܕܝܠܕܐ ܗܘ ܒܘܪܟܐ ܠܒܗܕܐ. ܡܩܠܝܠ ܒܘܡܦܐ ܗܕܐ ܗ݇ ܙܘܒܝܕܐ ܡܫܟܚܢܐ ܐܘ ܙܘܒܝܕܐ ܕܝܠܗ ܐܝܟ ܕܠܘ ܝܠܐ ܒܨܘܪܬܐ (٥)

ܨܘܪܬܐ (١٠ - ٥) ܚܘܫܒܢܐ ܠܒܝܬܐ ܟܘܟܒܐ

(١٠ — ٨) ܟܘܟܒ̈ܐ ܬܪ̈ܝܢܝܐ (Binary Stars)

ܘܐܦ ܦܠܓܐ ܡܢܗܘܢ (ܫܘܦܐ ܬܪ̈ܝܢܝܐ) Binary System ܘܝܠܗ ܟܠ ܬܪܝܢ ܟܘܟܒܐ ܡܕܝܢܐ ܘܐܡܝܪܐ ܒܝܕ ܛܘܦܣܐ ܡܫܘܬܦܐ. ܘܚܠܐ ܕܛܘܦܣܐ ܒܝܢܬܗܘܢ ܡܟܝܢ ܠܦܪܬܠܬܗ ܚܕܐ ܡܢܝܠܗ، ܕܡܘܡܪܗ ܡܬܘܬܦܐ.

ܚܕܐ ܡܢ ܡܫܟܚܢܘܬܐ ܕܦܝܫܐ ܥܕܟܐ ܕܐܝܬ ܟܘܟܒܐ ܬܪ̈ܝܢܝܐ ܐܬܐ ܡܢ ܦܠܓܬܐ ܕܟܘܟܒܐ ܥܕܘܝܐ ܠܐ ܥܠܝܐ ܒܒܠܬܐ ܕܝܘܡܬܐ ܕܚܠܐ ܡܬܪܘܬܐ ܕܡܟܒܝܢ ܠܬܪܬܐ ܕܟܡܫܬܐ ܘܡܫܪܬܐ ܕܒܛܦܬܐ ܘܥܕܐ ܟܘܟܒܐ ܥܕܘܝܐ ܠܬܪܝܢ ܟܘܟܒܐ ܐܘ ܝܬܝܪ ܘܡܬܪܬܐ ܕܡܫܘܚܬܐ ܕܙܘܥܐ ܕܦܪܬܠܬܐ: ܬܪܬܐ ܕܡܘܫܚܐ ܘܡܬܪ̈ܬܐ ܠܒܘܪܟܬܐ ܐܝܟܐ ܕܦܝܫܝ ܗܪܡܐ ܕܫܘܦܐ ܐܡܪܐ ܥܡ ܚܕܕܐ ܦܘܫܝܐ

(١٠ — ٩) ܐ̈ܕܫܐ ܕܟܘܟܒ̈ܐ ܬܪ̈ܝܢܝܐ ܦܘܫ̈ܝܐ

ܩܕܡܝܐ ܕܡܦܠܚܠܗ ܦܠܓܘܬ ܟܘܟܒ̈ܐ ܬܪ̈ܝܢܝܐ ܝܠܗ ܗܪܫܠ ܡܠܝܟ ܦܪܫ ܒܫܢܬܐ ١٨٠٢ ܡ ܘܒܬܪܗ ܐܝܬ ܗܘܐ ܡܢܝܢܐ ܕܟܘܟܒ̈ܐ ܬܪ̈ܝܢܝܐ ܦܘܫܝܐ ܒܟܢܫܐ ܘܦܪܝܫܠܗ ܡܢ ܟܘܟܒ̈ܐ ܬܪ̈ܝܢܝܐ ܓܠܝܢܝܐ ܒܝ ܡܦܝܓܠܗ ܠܟܘܟܒ̈ܐ ܬܪ̈ܝܢܝܐ :

ܘܐܝܬ ܡܢ ܟܘܟܒ̈ܐ ܐܚܪ̈ܢܐ ܐܝܟ ܚܕ̈ܐ ܦܘܫܝܐ. ܘܗܘܐ ܐܚܪ̈ܢܐ ܓܠܝܢܝܐ ܒܦܪܫܘܬܐ ܕܪ̈ܘܚܩܐ ܟܘܟܒ̈ܐ ܐܝܟ ܒܪܘܟܒܐ ܚܕ ܡܢܝܢܗ ܕܐܝܟ ܐܦܘܦܐ ܕܡܬܕܡܝܐ ܒܝ ܪܡܟܐ ܠܡܢܘܢܐ ܕܝܘܡܐ. ܐܝܟ ܐܬܘܦܐ ܘܓܘܠܐ ܗܢܐ ܘܩܡ ܒܠܡܐ ܠܡܢܘܢܐ ܕܟܠܢܐ. ܘܐܪܙܝ ܟܠ ܚܕܐ ܚܕ ܓܠܝܐ ܬܪ̈ܝܢܝܐ.

ܘܦܐܫ ܡܦܠܓܐ ܐܢܐ ܬܪ̈ܝܢܝܬܐ ܠ :

١ - ܬܪ̈ܝܢܝܬܐ ܡܬܚܙܝܢܝܬܐ Visual Binaries :

ܘܝܠܗ ܕܡܨܝܚ ܕܚܙܝܠܗ ܒܥܝܢܐ ܦܠܝܚܘܬ ܐܘ ܒܬܠܣܟܘܦ. ܘܡܢܝܗ ܬܪ̈ܝܢܝܐ ܕܐܪܙܝ ܡܢ ܟܘܟܒ̈ܐ ܕܡܚܙܐ ܘܟܘܟܒ̈ܐ ܕܗܘܘ ܒܩܠܝܠܐ ܕܪ̈ܒܐ ܠܟܘܪܐ

٢ - ܬܪ̈ܝܢܝܬܐ ܓܠ̈ܠܝܬܐ Spectroscopic Binaries :

ܘܝܠܗ ܬܪ̈ܝܢܝܬܐ ܕܓܠܝ ܠܪܘܡܐ ܐܝܟ ܕܝܠܗ ܟܘܟܒ̈ܐ ܠܚܘܪܐ ܐܝܟ ܟܘܟܒ̈ܐ (ܡܙܘܪ) ܘܐܘ ܠܡܘܪܟܢܘܬܐ ܕܦܪܘܝܗ ܟܘܟܒ̈ܐ ܡܢ ܚܕܪܐ ܡܢܐ ܕܒܚܡܝܢܐ ܦܪܝܫܬܐ ܒܝܢܬܗ ܐܘ ܒܪܘܪܒܐ ܕܬܠܣܟܘܦ ܡܘܬܒܪܢܐ ܐܠܐ ܒܡܦܠܚܬܐ ܕܣܦܩܛܪܘܣܟܘܦ ܡܣܒܪܢܐ ܦܝܠܗ ܚܘܝܐ ܕܟܘܟܒ̈ܐ ܡܙܘܪ ܐܝܬܠܗ ܓܠ̈ܠܝܐ ܕܝܠܗ ܘܦܪ̈ܝܫܐ ܒܝ ܓܠܠܐ ܒܣܦܩܛܪܐ ܕܘܓܠܐ ܡܢ ܣܓܘܦܐ ܓܠ̈ܠܝܐ ܚܕܡܢܐ ܒܪܒܐ ܘܒܣܦܩܛܪܐ ܠܚܘܪܐ ܚܕܡܢܐ ܒܪܒܐ ܐܚܪܢܐ ܠܦܘܬ ܘܓܠܐ ܕܦܪܘܝܗ ܟܘܟܒ̈ܐ ܚܕܪܐ ܡܢܓܕܐ. ܕܡܘܡܪܝ ܘܝܠܗ (ܡܙܘܪ ܐ ܘ ܒܙܘܪ ܒ)

٣ - ܬܪ̈ܝܢܝܬܐ ܓܘܠܛܝܬܐ Eclipsing Binaries :

ܘܝܠܗ ܡܢ ܐܢܐ ܬܪ̈ܝܢܝܬܐ ܓܠ̈ܠܝܬܐ ܐܠܐ ܐܢܐ ܬܪ̈ܝܢܝܬܐ ܒܡܣܝܢ ܕܒܘܪܐ ܕܦܪܘܠܬܐ ܕܬܪ̈ܝܢܝܐ ܝܠܗ ܒܡܘܫܐ ܕܒܘܪܐ ܕܣܝܓܐ ܕܣܘܪܬܐ ܒܢܬܗ ܡܢܐ ܕܡܬܒܒ ܠܬܪܝܬܐ ܕܚܕ ܡܢܝܗ ܠܒܗܪܐ ܐܚܪܢܐ ܡܢ ܟܘܟܒ̈ܐ ܬܪ̈ܝܢܝܐ ܠܣܘܝܢܐ ܘܒܝܘܪܬܐ ܢܗܝܪܬܐ. ܘܒܪܢܐ ܗܘܟܪܢܘܬܐ ܕܓܘܠܛܐ ܗܝܢܘ. ܘܦܠܓܐ ܕܐܘܐ ܒܣܠܩ ܒܗܘܪ ܕܒܗܪܐ ܡܓܢܝܐ ܒܠܝ ܡܢ ܓܘܫܐ ܘܒܝܘܪܬܐ ܕܘܪܬܢܝܬܐ. ܡܢ ܐܢܐ ܬܪ̈ܝܢܝܬܐ ܟܘܟܒ̈ܐ (ܓܘܠܐ) ܕܡܘܒܚܠܗ ܥܪ̈ܒܝܐ ܘܦܫܠܗ ܒܠ ܒܫܡܗ (Algol) ܗܘ ܠ ܗܘܐ.

ܒܪܓܐ ܕܦܘܠܣܪ ܚܒܝܐ ܗܕܢܝܬܐ ܐܝܩܘܢܐ ܗܠܘ ܕܟܐ ܟܘܡ ܐܘܟܝܬܠ

ܡܘܕܥܢܘܬܐ ܕܟܐ ܟܠ ܕܠܥܐ ܦܘܫܐ ܕܠܐ ܟܘܟܒܐ ܐܝܟ ܣܘܥܪܢܐ ܕܦܠܓܐ

ܕܡܬܕܪܐ ܦܫܝܛܐ ܠܗܕܘܝܗ ܟܘܟܒܐ ܕܗܕܢܝܐ ܘܐܦ ܟܘܕܢܘܬܐ ܦܫܝܛܬܐ ܠܗ

ܘܟܢܘܫܐ ܡܬܕܘܪܢܐ ܠܚܕܘܕܐ ܗ ܘܐܦ ܟܘܠܗ ܘܨܘܪܬܐ (٦) ܚܠܝܐ ܗܠܘ

ܠܐܣܢܘܬܐ ܟܡ ܥܣܠܩܬܐ ܕܟܘܕܢܘܬܐ ܟܕ ܘܟܢܐ ܕܘܕܬܢܐ ܟܕ ܟܕܡܐ

ܡܘܕܢܘܬܐ ܕܦܘܠܣܪ ܟܡܥܘܠܐ !! ܐܝܟ ܕܦܠܠܗ ܟܘܟܒܐ ܙܡܘܣܬܢܐ ܘܟܘܕܐ

ܕܟܝܠܬܐ ܟܗܕ ܡܕܣܐ ܠܟܘܕܐ ܕܟܝܠܬܐ ܘܟܦܪܐ ܟܘܕܢܘܬܐ ܟܟܘܙܐ ܘܟܕܣܐ

ܡܘܕܢܘܬܐ ܕܦܘܠܣܪ

ܨܘܪܬܐ (١٠ - ٦) ܚܘܦܐ ܟܘܕܢܐ ܘܡܘܫܚܘܬܐ ܕܣܦܘܦܐ ܕܦܠܠܐ
ܠܡܦܟܗܐ ܕܦܘܠ

(١٠ — ١٠) ܟܢܘܫܝܐ ܟܘܟܒܢܝܐ (Sar Clusters)

ܦܝܫ ܡܕܥܐ ܥܡܐ ܕܟܢܘܫܝܐ ܟܘܟܒܢܝܐ ܠܟܠ ܡܩܪܒܐ ܡܢ ܡܐܬܐ ܘ١٠ ܠܡܠܝܘܢ. ܟܘܟܒܐ. ܘܗܘܐ ܡܚܙܝܐ ܕܟܢܘܫܝܐ ܗܢ ܟܠ ܟܘܟܒܐ ܘܐܣܛܪܐ ܐܝܟ ܥܒܕܐ ܕܝܘܡܢܐ ܘܐܝܟ ܟܘܟܒܐ ܡܠܝܐ ܕܠܗ ܠܚܕܕܐ ܕܡܬܒܪܝܢܘܬܐ ܦܫܝܛܐ ܐܝܟ ܕܡܘܦܩܬܐ. ܟܕ ܟܠ ܟܢܘܫܝܐ ܕܟܘܟܒܐ ܗܢܘܢ ܡܢ ܕܟܘܟܒܐ ܕܡܢܝܢܐ ܕܢܗܘܘܢ ܘܡܕܪܟܝܢ ܕܒܗ ܒܢܝܢܐ ܕܢܗܘܘܢ ܘܐܡܪܝ ܒܬܪ ܣܓܝ ܕܪܩܝܥܐ ܕܢܦܘܩܬܐ ܡܬܘܒܩܬܐ.

ܘܦܫܝܢ ܡܦܘܠܓܝܢ ܟܢܘܫܝܐ ܕܟܘܟܒܐ ܠܬܪܝܢ ܐܕܫܐ:

ܐ ـ ܟܢܘܫܝܐ ܦܬܝܚܐ Open Clusters

ܗܠܝܢ ܟܢܘܫܝܐ ܐܢܘܢ ܦܬܝܚܐ ܘܦܪܝܫܐ. ܡܢܝܢܐ ܕܝܠܗܘܢ ܘܡܫܚܠܦ ܕܝܠܗ ܒܝܢ ١٠ ܘܠ ١٠٠٠ ܟܘܟܒܐ ܐܢܘ ܟܠ ܟܢܘܫܝܐ ܘܗܘܝ ܡܫܬܟܚܝܢ ܐܢܘ ܒܦܪܬܐ ܚܠܒܢܝܬܐ ܕܡܘܦܩܬܐ. ܘܗܘܝ ܐܝܟ ܟܘܟܒܐ ܙܗܝܪܐ ܡܢ ܟܘܟܒܐ ܟܪܝܐ ܘܡܢ ܥܕܢܐ ܦܠܝܓܐ ܘܡܢ ܐܝܟ ܟܢܘܫܝܐ ܐܢܘ ܦܬܝܚܐ. ܟܢܘܫܝܐ ܕܚܠܒܐ ܟܘܟܒܢܝܐ ܕܦܘܪܐ B.O.

ܒ ـ ܟܢܘܫܝܐ ܟܘܪܢܝܐ Globular Clusters

ܗܠܝܢ ܟܢܘܫܝܐ ܠܐ ܐܢܘ ܦܬܝܚܐ ܐܠܐ ܟܠ ܚܕ ܒܝܬ ܟܢܫܐ ܘܡܢܝܢ ܟܢܘܫܝܐ ܟܘܪܢܝܐ ܡܢ ܚܕܡܐ ܐܠܦܐ ܠܡܠܝܘܢ. ܟܘܟܒܐ ܡܢ ܟܘܟܒܐ ܡܕܢܚܝܐ ܕܡܫܬܟܚܝܢ ܒܨܘܪܬܐ ܕܟܘܪܬܐ ܘܥܒܕܝ ܠܚܕܕܐ ܕܟܘܟܒܐ ܒܡܬܩܪܒܘ. ܘܡܢܘܬܐ ܡܬܩܪܒܘ. ܐܡܢܝܢ ܒܐܪܥܐ ܡܢ ܡܢ ܦܘܪܐ ܘܟܢܘܫܝܐ ܟܘܪܢܝܐ ܡܢܝܢܐ ܕܝܠܗ ܪܒܐ. ܒܝܢ ܡܕܢܚܝܐ ܒܟܠ ܡܢܝܢ ܐܝܟ ٢٠٠٠٠ ܒܝܬ ܒܐܪܥܐ ܐܨܘܪܬܐ (٧) ܠܟܢܘܫܝܐ ܟܘܪܢܝܐ.



ܐܨܘܪܬܐ (١٠ - ٧)
ܟܢܘܫܝܐ ܟܘܪܢܝܐ

ܘܡܣܘܪܛܢܐ (٢) : ܠܗܠܝܢ ܡܠܝܘ ܠܦܘܪ̈ܫܢܐ ܒܝܢ ܥܢܩܘܕܐ ܦܫܝܛܐ ܘܥܢܩܘܕܐ ܟܘܪܝܢܝܐ

	ܥܢܩܘܕܐ ܦܫܝܛܐ	ܥܢܩܘܕܐ ܟܘܪܝܢܝܐ
١ . ܕܘܟܬܐ ܕܡܫܟܚܘܬܗܘܢ ܕܒܓܠܓܠܐ	ܙܘܥܐ	ܥܘܡܩܐ
٢ . ܡܢܝܢܐ ܕܟܘܟܒܝܗܘܢ	(١٠ - ١٠٠٠)	ܡܢ ܐܠܦܐ ܠܡܠܝܘܢܐ
٣ . ܨܘܪܬܐ ܠܐ ܣܕܝܪܐ ܗܢܘܢ	ܠܐ ܕܕܡܝܐ ܠܟܘܪܐ	ܠܐ ܣܕܝܪܬܐ ܘܟܘܪܬܐ
٤ . ܦܫܝܛܘܬܐ ܕܡܘܠܕܐ ܒܝܢ ܟܘܟܒܐ	ܐܝܬ ܒܗܪܝܪܘܬܐ	ܐܝܬ ܒܦܫܝܛܘܬܐ ܩܠܝܠܬܐ
٥ . ܦܪܘܫܘܬܐ ܕܣܦܝܪܐ ܠܗܘܢ	ܥܛܝܪܐ ܒܗܦܟܐ	ܚܣܝܪܝܢ ܡܢ ܦܫܝܛܘܬܐ ܩܠܝܠܬܐ
٦ . ܒܘܡܝܐ	ܩܠܝܠܐ ܡܢ ١٠٠ ܡܠܝܘܢ ܫܢܝܢ	ܝܬܝܪ ܡܢ ܒܠܝܘܢ ܫܢܝܢ

(١٠ — ١١) ܥܪ̈ܦܠܐ ܕܢܗܝܪ̈ܐ (Nebulae)

ܥܪ̈ܦܠܐ ܕܢܗܝܪ̈ܐ ܐܝܬܝܗܘܢ ܥܢܢ̈ܐ ܪ̈ܒܐ ܕܐܒܩܐ ܡܢ ܓܙܐ ܘܐܒܩܐ ܒܝܬ ܟܘ̈ܟܒܐ ܡܢ ܚܙܘܬܐ ܕܐܝܬ ܠܗ ܕܘܟܬܐ ܕܡܢܝܢ ܘܥܪ̈ܦܠܐ ܕܢܗܝܪ̈ܐ ܡܬܦܠܓܝܢ ܠܐܪܒܥܐ ܐܝܟ :

ܐ . ܥܪ̈ܦܠܐ ܕܢܗܝܪ̈ܐ ܢܘܗܪܐ ܒܗ ܡܚܙܝܢ ܠܗ ܢܘܗܪܐ.

ܒ . ܥܪ̈ܦܠܐ ܕܢܗܝܪ̈ܐ ܠܐ ܢܘܗܪܐ ܘܡܚܙܝܢ ܠܟܠ ܢܘܗܪܐ ܘܠܐ ܕܡܛܠ ܡܢ ܢܘܗܪܐ ܘܥܪ̈ܦܠܐ ܕܢܗܝܪ̈ܐ ܢܘܗܪܐ ܦܫܝܛ ܦܠܢܝܬܐ ܠܬܠܬܐ ܐܕܫܝܢ :

١ . ܥܪ̈ܦܠܐ ܕܢܗܝܪ̈ܐ ܦܠܢܝܬܐ Planetary Nebulae : ܐܢܝܢ ܐܕܫܐ ܡܢ ܥܪ̈ܦܠܐ ܕܢܗܝܪ̈ܐ ܚܘܪ̈ܢܝܐ ܕܐܣܛܝܪ̈ܐ ܐܝܬܝܗܘܢ ܡܬܕܡܝܢ ܐܝܟ ܨܘܪܬܐ ܡܛܠ ܚܙܝܬܗ ܕܡܬܚܙܝܢ ܕܡܝܐ ܠܨܘܪܬܐ ܕܐܣܛܘܦܐ ܕܦܠܢܝܬܐ ܕܡܢ ܗܪܟܐ ܫܡܗܐ ܗܢܐ ܕܐܝܟ ܦܬܝܠܘ ܡܢܗ ܕܚܕܐ ܫܢܬܐ ܘܐܝܟ ܕܐܣܛܝܪ̈ܐ (٨) ܘܐܝܬܝܗܘܢ ܚܠܠܐ ܚܘܪ̈ܢܝܐ ܕܡܬܚܙܝܢ

ܨܘܪܬܐ ١٠ - ٨

٢ . ܥܢܦ̈ܠܐ ܪ̈ܘܚܢܐ ܗܘܦ̈ܝܐ ܦܘܪ̈ܦܝܐ Diffuse Nebulae : ܘܒܠܝܗ ܠܐ
ܡܬܒܚܢܐ ܘܠܐ ܡܬܚܙܝ̈ܢ ܕܨܘܪ̈ܬܐ ܘܝܘܢܝܗ ܕܡܢ ܠܟܘܟ̈ܒܐ ܢܗܝܪ̈ܐ ܩܪܝܒܝܗ ܒܗܘܢ̈ܐ
ܕܒܘܟ̈ܒܐ ܐܝܟ ܒܨܘܪܬܐ ٩ .

ܨܘܪܬܐ
١٠ - ٩

٣ - ܥܪܦܠܐ ܕܥܡܛܐ ܥܡܘܛܬܐ Dark Nebulae : ܐܝܢܐ ܥܪܦܠܐ ܕܥܡܛܐ ܠܐ ܡܦܠܛܝܢ ܢܘܗܪܐ ܡܛܫܝܢܐ ܘܡܟܣܝܐ ܥܠ ܢܘܦܝܗ ܥܕܡܛܝܗ ܠܢܘܗܪܐ ܐܚܪܢܐ ܡܢ ܟܘܟܒܐ ܕܩܪܝܒܐ ܐܝܟ ܒܨܘܪܬܐ (١٠).

ܨܘܪܬܐ (١٠ - ١٠)

(١٠ - ١٢) ܗܘܠܐ ܒܝܢ ܗܕܝ ܟܘܟܒܐ Intersllar matter

ܗܘܠܐ ܒܝܢ ܗܕܝ ܟܘܟܒܐ ܥܒܕ ܠܟܘܟܒܐ ܝܗܒ ܡܬܝܠܕܘܬܐ ܡܢ ܡܐ ܕܝܠܗ ܐܠܐ ܒܡܐܝܬ (ܘܗܘܐ ܗܘܠܐ ܐܝܟ ܒܡܫܘܚܬܐ ܡܢ ܗܘܦܐ ܘܐܒܩܐ ( ) ܘܐܝܟܢܐ ܕܡܬܝܠܕܘ ܐܝܟ ܥܕܬܗ ܠܢܘܗܪܐ ܒܗܘ ܕܗܘܐ ܡܟܣܐ ܥܠ ܩܝܡܘܬܐ ܒܬ ܩܕܡܐ ܥܒܘܕ ܡܢ ܦܪܥܬܗ ܠܟܠܠܐ ܕܪܐ ܡܢ ܢܘܗܪܐ ܦܠܛܢܐ ܡܢ ܟܘܟܒܐ ܡܬܚܙܐ ܘܫܘܚܠܦܗ ܒܬ ܗܕܡܐ ܘܡܠܬܗ ܐܠܐ ܝܗܒ ܐܚܪܢܐ ܥܕܡܐ ܕܡܢܬܐ ܘܕܡܝ ܚܘܕܐ ܐܝܟ ١ ٪ ܡܢ ܗܘܠܐ ܒܝܢ ܟܘܟܒܐ ܘ ٩٩ ٪ ܦܬܝܐ ܐܝܠܗ ܗܘܦܐ ܦܪܝܫܐ ܒܝܢ ܟܘܟܒܐ.

(١٠ - ١٣) ܓܘܕܐ (ܫܒܝܠ ܬܒܢܐ) Galaxy

ܗܕܝ ܓܘܕܐ ܡܢ ܡܠܝܘܢܐ ܦܠܝܓܐ ܕܗܕܝ ܡܢ ܟܘܟܒܐ ܠܣܘܓܐܐ ܐܝܟ ܫܡܫܐ ܘܡܠܝܘܢܐ ܗܕܢܝܢܐ ܘܡܠܝܘܢܐ ܗܢܝܢܐ ܘܡܢ ܥܢܢܐ ܟܘܟܒܝܐ. ܐܪܐ ܡܠܝܘܢܐ ܟܘܟܒܐ ܕܦܫܝܢ ܟܡܫܬܐ ܐܝܟ ܐܡܝܢ ܐܠܦܐ ܡܠܝܘܢܐ ܕܟܘܟܒܐ (١٠٠.٠٠٠.٠٠٠.٠٠٠ ܟܘܟܒܐ) ܥܡ ܥܪܦܠܐ ܕܥܡܛܐ ܓܘܕܐ ܥܒܘܕ ܡܢ ܗܘܠܐ ܒܝܢ ܟܘܟܒܐ ܒܓܘܢܝܗ ܡܛܠ ܠܣܘܓܐܬܐ ܕܫܒܝܠ ܬܒܢܐ. ܓܘܕܐ ܚܕ ܡܢ ܕܣܟܠܐ ܐܝܟ ܚܕ ܠܗܟܢܐ ܢܬܝܕܥ ܠܨܘܪܬܗ ܘܒܗܠܝܢ ܡܘܕܥܝܢ ܡܢ ܟܠ ܡܫܬܐ ܕܟܠ ܡܢ ܓܘܕܐ ܡܠܝܘܢܐ ܕܘܟܬܐ ܘܡܣܬܝܗ ܐܝܟ ١٠٠ ܐܠܦܐ ܡܠܝܘܢܐ ܕܓܘܕܐ ܒܓܘܢܝܗ ܗܕܝ ܡܠܝܘܢܐ ܕܟܕܡܐ.

ܘܗܘܐ ܕܡܫܬܒܚ ܠܗ ܝܠܗ ܡܢ ܐܘܐ ܚܘܦܐ ܒܘܕܢܐ ܡܕܝܚܐ ܕܡܫܚ ܟܠܝܠܘܬܐ ܕܡܨܥܝܐ ܡܢ ܓܪܒܝܐ ܡܕܝܚܐ ܠܗ ܡܢܝ ܡܕܪܒܢܐ ܒܡܘܒܠܐ ܕܒܡܫܢܐ. ܘܐܘܐ ܒܘܪܐ ܡܕܝܚܐ ܓܦܦܐ ܡܠܘܝܐ ܕܒܘܟܒܐ ܕܬܪܝܢ ܚܕ ܕܪܓܐ ܕܡܘܕܝ.

ܡܫܘܐܠܝܬ ܕܪܒܢܬܐ ܡܫܘܠܛܢܐ ܕܟܘܟܒܝܬܐ ܚܕ ܡܢ ܢܕܘܟܐ ܠܒܘܦܐ ܓܘ ܒܡܫܐ ܡܢ ܐܠܗ ܕܦܠܓ ܘܚܣܒ ܐܨܘܪܬܐ ܕܐܘܐ ܡܘܕܐ ܒܐܨܘܪܬܐ ܓܠܘܠܝܐ ܘܒܐ ܓܠܘ ܦܓܪܐ ܓܒܘܪܬܐ ܐܨܘܪܬܐ (١١) ܘܦܪܝ ܡܦܘܠܓܐ ܡܘܕܐ ܠܬܠܬܐ ܦܘܫܐ ܪܒܐ:

١ . ܦܘܫܐ ܡܨܥܪܘܢܐ . ܘܝܠܗ ܢܘܦܫܐ ܕܡܘܕ ܓܘܪܒܢܐ ܦܝܪ ܡܪܐ ܢܘܗܪܐ ܕܡܘܕܐ.

٢ . ܕܪܓܐ ܚܠܙܘܢܝܐ ܐܘ ܐܘܦܩܝܐ.

٣ . ܚܘܓܬܐ ܐܘ ܟܠܝܠܐ ܕܓܪܕܝ ܒܡܘܕܐ ܘܡܫܚ ܠܪܚܘܩܘܬܐ ܓܒܘܪܬܐ ܪܒܐ.

ܘܡܫܚܐ ܡܓܪܬܐ ܕܡܘܕܐ ١٠٠ ܐܠܦܐ ܫܢܝ̈ ܢܘܗܪܐ ܘܢܦܠܐ ܫܡܫܐ ܓܘ ܦܢܝܬܐ ܕܕܪܓܐ ܚܠܙܘܢܝܐ ܘܟܠ ܒܡܟܪܐ ٣٠ ܐܠܦܐ ܫܢܝ̈ ܢܘܗܪܐ ܡܢ ܡܨܥܪܘ. ܘܙܝܢ ܡܘܕܐ ܚܕ ܡܨܥܪܘܢܗ ܘܡܢܐ ܕܦܪܬܠܬܐ ܘܫܡܫܐ ܦܪܬܠܐ ܚܕܐ ܡܨܥܪܘ. ܒܡܠܘܠܘܬܐ ٢٥٠ ܒܒ ܪܦ ܡܘܕܪܢܝܬ ܘܐܡܫܐ ܠܚܕܐ ܕܘܪܬܐ ܒܡܫܚܐ ٢٥٠ ܡܠܝܘܢܐ ܫܢܝ̈ ܡܘܪܢܝܬ ܘܦܪܝ ܡܪܝܬܐ ܒܕܘܪܐ ܒܪܝܬܢܝܐ (ܫܢܬܐ ܒܪܝܬܢܝܬܐ).

ܨܘܪܬܐ (١٠ - ١١)

ܡܢ ܐܝܠܢܐ ܕܟܘܟܠܠܐ ܕܝܘܣܘܣܬܐ ܐܬܪܝܬܐ ܕܝܘܣܝܬܐ ܕܝܘܦܟܐ ܕܡܘܨܠܬܐ ܕܝܘܣܝܬܐ ܝܠܗ ܡܟܣܟܝܗ ܠܓܘܫܡܐ ܫܡܫܢܐ ܢܘܟܪܝܐ ܕܓܘܕܐ ܘܡܢ ܡܟܘܟܐ ܣܠܠܐ ܠܓܠܓܠܢܝܬܐ ܕܝܘܣܝܐ. ܘܡܢ ܕܫܘܝܬܐ ܕܣܡܝܐ ܕܟܐ. ܘܝܠܗ ܡܢ ܓܘܫܡܐ ܫܡܫܢܐ ܟܕ ܝܕܝܥܐ ܠܡܦܪܢܘܬܐ ܕܓܘܡܦܐ (١٠ ٦٥ ܓܘܠ ܡܘܪܓܝܬܐ). ܘܦܫܛ ܣܘܫܦܐ ܐܢܐ ܓܘܫܡܐ ܫܡܫܢܐ ܟܠܟܐ ܡܢ ܡܘܕܐ ܕܣܡܝܐ ܕܟܐ. ܘܟܪܐ ܕܗܘܝ ܡܘܕܐ ܟܕ ܕܣܡܝܐ ܓܘ ܕܡܝܟܐ. ܘܡܢ ܐܝܠܢܐ ܕܝܠܬܗ ܘܟܝܗ ܓܘ ܕܡܝܟܐ ܕܫܡܐ ܡܢܢ ܘܟܠܘܠܘܬܐ ܝܠܝܐ ܕܟܐ.

ܘܡܘܟܪܢܝܬ ܦܬܐ ܟܠܬܐ ܡܠܘܠܘܬܐ ܕܪܫܡܬܗ ܡܢܢ ܟܕ ܟܠܬܐ ܕܓܠܠܐ ܟܘܟܒܐ ܕܟܘܕܐ ܦܠܓܐ ܡܢܗ ܘܡܓܠܐ ܠܗ ܟܕ ܫܡܘܗ ܣܠܘܓܗ ܓܠܠܐ ܠܢܬܝܗ ܙܘܟ ܟܘܦܐ ܡܡܘܡܐ ܡܢ ܓܠܠܐ ܠܝܕܬܐ ܕܡܘܟܟܗ ܟܠܐ ܓܠܢܝܬ ܠܦܘܬ ܡܟܟܕܢܘܬܐ ܕܝܘܟܠܕ ܡܢ ܕܡܫܘܐ ܕܓܘܫܡܐ ܫܡܫܢܐ ܝܠܗ ܟܢܝܟܢܘܬܐ ܕܪܫܡܬܐ ܡܢܢ.

١٠ . ١٥ ܡܟܫܬܐ ܕܟܪܝܬܐ ܘܟܕܝܡܘܬܐ ܕܪܫܡܬܐ ܕܡܘܕܐ

ܡܘܢܕܟܠܗ ܢܘܪܐ ܥܠ ܫܢܬܐ ١٩٢٩ ܒ ܕܡܘܕܐ ܕܫܡܝ ܡܢܢ ܟܟܠܝܗ ܙܘܟܐ ܘܟܠܡܝ ܠܐ ܣܡܘܬܐ ܐܬܡܬܐ ܣܕ ܕܟܐ ܟܡ ܕܫܡܘܬܐ ܘܪܫܡܬܐ ܓܠܠܬܐ ܙܘܟ ܡܡܘܡܐ ܘܡܢܗ. ܥܠ ܐܡܪ ܡܠܘܠܘܬܐ ܕܪܫܡܬܐ ܕܡܘܕܐ ܦܫܛܐ ܐܬܡܢܝܬ ܝܟ ܟܘܟܕܗ ܡܢܢ:

ܩ = ܒ . ܛ

ܟܕ ܩ = ܡܠܘܠܘܬܐ ܕܪܫܡܬܐ ܒܝܘܡܐ ܕܣܝܓܐ ܕܣܘܪܝܬܐ.

ܛ = ܟܘܟܒܐ ܕܡܘܕܐ

ܒ = ܡܟܝܬܐ ܕܦܫܡܘܬܐ (ܡܟܝܬܐ ܕܥܠ، ܘܟܘܢܠܗ ܫܘܐ (١٧ ܟܡ ܕܦ) ܠܟܠ ܡܠܝܘ. ܫܢܬܐ ܟܘܕܝܬܐ ܘܫܘܐ (٥٥ ܟܡ ܕܦ) ܠܟܠ ܡܠܝܘܢ ܦܪܫܐ ܡܘܠܟܐ ܦ. ܦ).

ܘܐܢܐ ܗܘܟܠܗ ܝܠܗ ܠܟܠ ܡܠܝܘ. (ܦ . ܦ) ܘܣܕܐ ܡܠܘܠܘܬܐ ܟܟܘܢܠܐ ٥٥ ܟܡ ܕܦ ܡܢ ܓܘܦܫܐ. ܣܕ ܡܘܕܐ ܘܐܢܐ ܕܫܡܐ ١٠ ܡܠܝܘ. (ܦ . ܦ) ܟܘܐܢܠܗ ܕܫܡܬܐ ܙܘܟ ܡܡܘܡܐ ܟܕܘܟܠ ܟܡܠܘܠܘܬܐ ܕܪܫܡܬܐ ٥٥٠ ܟܡ ܕܦ ܐܠܦܐ.

ܗܘܐ ܪܗܛܐ ٢٠ ܡܝܠܝ̈ (ܦ.ܦ) ܒܗܘܐܠܗ ܡܠܘܠܘܬܐ ܕܫܢܝ̈ܐ ١١٠٠ ܒܡ ܪܦ
ܘܗܠܐ ܘܐܦ ܪܗܛܐ ܙܘܥ ܡܣܘܩܐ ܒܪܡܘܥܐ ܒܡܠܘܠܘܬܐ ܕܫܢܝ̈ܐ ١١٠٠
ܒܡ ܪܦ. ܘܐܘܐ ܡܣܠܘ ܠܗ ܕܡܢܘ. ܘܟܠ ܦܢܡ ܒܪܡܘܬܐ ܕܫܢܝ̈ܐ ܕܡܘܕܐ
ܘܫܢܝ̈ܐ ܕܡܘܕܐ ܐܝܟ ܢܡܘܙܐ ܕܟܠ ܥܠܡܐ ܕܠܘܬܐ ܡܢ ܡܛܠܬܐ ܡܡܣ
ܒܢܦܫܗ ܒܐܡܢܘܬܐ ܐܝܟ ܕܝܠܗ ܝܠܦܐ ܒܐܡܚܘܬܐ (١٢)



ܐܡܚܘܬܐ (١٠ - ١٢)

ܘܗܠܐ ܘܐܦ ܒܪܒܝܬܐ ܝܠܗ ܒܐܝܒܝܢܘܬܐ ܕܡܕܝܢܬܐ ܐܝܟܐ ܕܗܘܐ ܢܡܘܦ ܝܗ
ܒܪܒܝܬܐ (ܚܙܝ ܐܡܚܘܬܐ ١٤)

ܢܡܘܬܐ (ܒ) ܡܕܝܬܐ ܕܗܒܠ ܠܐ ܝܠܗ ܡܕܝܬܐ ܠܠܒܝܟ ܐܠܐ ܢܣܠܟ ܠܦܘܟ
ܡܕܝܢܐ ܘܒܢܐ ܒܡܕ ܕܐܘܐ ܡܢܝܬܐ ܝܠܗ ܒܐܘܪܚܘ ܢܕܒܬܐ ܕܡܒܐ ܒܘܡܪܐ
ܕܒܪܝܬܐ ܘܗܘ ܢܘܐ ($\frac{١}{ܒ}$) ܡܢ ܝܢܐ.

ܕܢ ܢܡܘܬܐ (ܒ) ܢܘܐ ١٧ ܒܡ ܪܦ ܠܟܠ ܡܝܠܝ̈ ܒܢܐ ܢܘܪܐ.

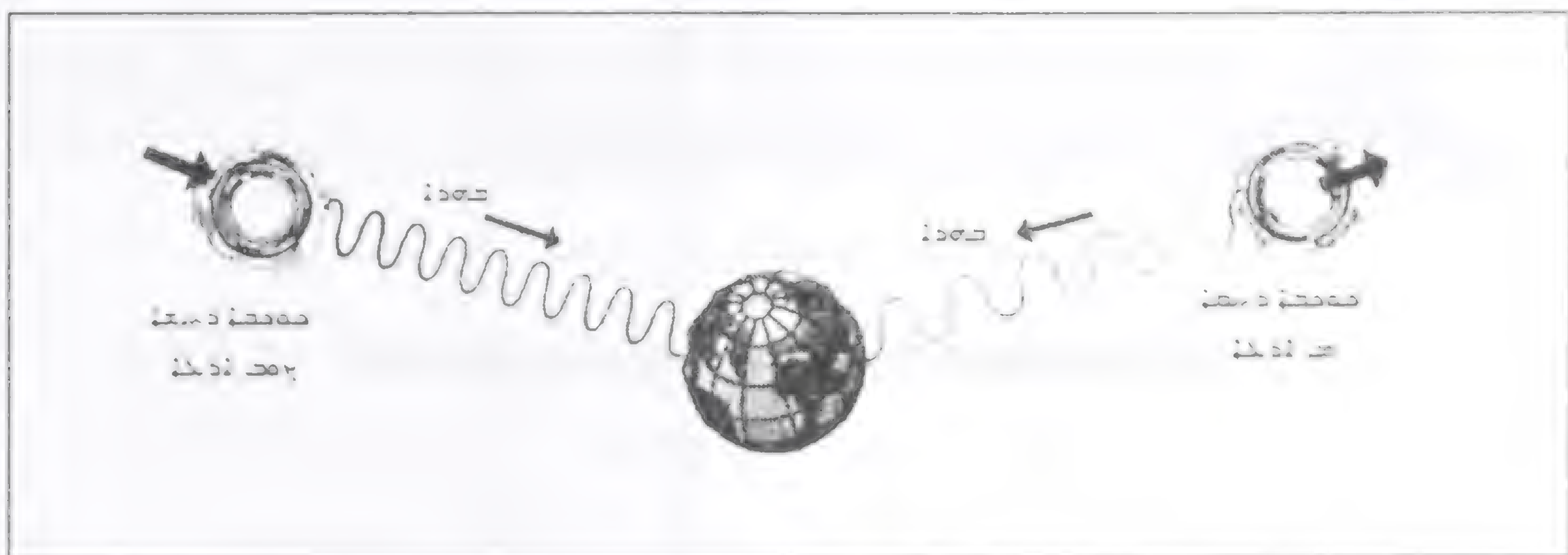
ܡܢܐ ܕܒܘܡܪܐ ܠܒܪܝܬܐ = $\frac{١}{ܒ}$

$$= \frac{١}{١٧} \times \frac{١٠^{٦} \times ٩.٤٥ \times ١٠^{١٢}}{٣.١٥ \times ١٠^{٧}}$$

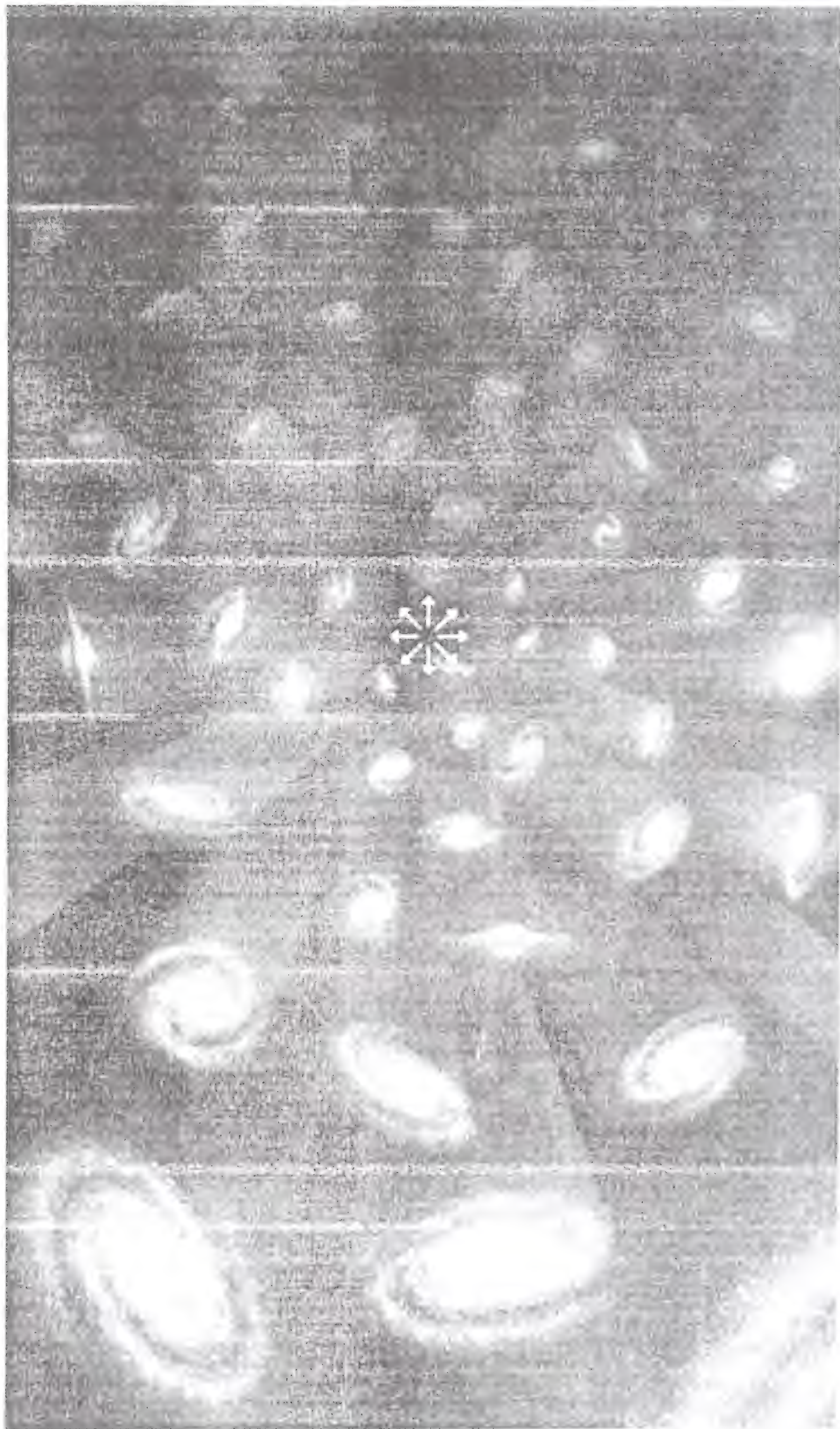
ܠܚܬܡܬܐ

ܒܕܝܘܬܐ ܕܕܘܦܠܪ ، ܐܝܟ ܒܩܠܐ ܗܟܢ ܒܐܣܛܪܘܢܘܡܝܐ ܕܟܘܟܒܐ ، ܟܘܟܒܐ ܕܪܚܝܩ ܡܢܢ ܒܡܠܘܠܘܬܐ ܡܢ ܕܝܘܡܐ ܡܬܚܙܐ ܠܗ ܢܘܗܪܐ ܐܣܡܩܐ ܡܢܗ ܒܝܕ ܢܘܗܪܐ. ܘܗܢܐ ܘܕܝܢ ܕܝܚܝܐ ܗܘܐ ܚܘܪܐ ܕܟܘܟܒܐ ܚܡܪܡܐ.

ܐܠܐ ܟܘܟܒܐ ܕܩܪܒ ܒܙܘܥܐ ܕܕܝܘܡܐ ܒܚܙܘܐ ܠܗ ܢܘܗܪܐ ܒܝܕ ܟܚܝܐ ܘܗܢܐ ܘܕܝܢ ܕܝܚܝܐ ܗܘܐ ܟܘܟܒܐ ܟܚܝܠܬܐ ܡܢ ܟܘܟܒܐ ، ܐܝܟ ܒܨܘܪܬܐ (١٣).



ܨܘܪܬܐ (١٠ - ١٣)



شكل ١٠ - ١٤

ܫܘ̈ܐܠܐ

ܫ١ : ܡܬܒܥ ܠܦܘܢܝ̈ܐ ܗܕܝܢܐ ܠܟܠ ܡܢ ܦܫܝܩܬܐ ܕܐܬܝ :

١ . ܟܘܟܒܐ (ܐ) ܟܝܠܗ ܓܠܠܐ (+٢) ܟܠܝܐ . ܘܟܘܟܒܐ (ܒ) ܟܝܠܗ ܓܠܠܐ (+٨) ܟܠܝܐ . ܙܗܝܪܘܬܐ ܕܟܘܟܒܐ (ܐ) ܒܥܘܬܐ :

ܐ . ܝܬܝܪ ܙܗܝܪܘܬܐ ܡܢ ܟܘܟܒܐ (ܒ)

ܒ . ܒܨܝܪ ܙܗܝܪܘܬܐ ܡܢ ܟܘܟܒܐ (ܒ)

ܓ . ܐܝܟܢܘܬ ܙܗܝܪܘܬܐ ܕܝܠܗ .

ܕ . ܚܠܝܫ ܣܝܡܘܬܐ ܚܕܬܐ .

٢ . ܦܫܠܘ ܚܫܒܬܐ ܕܢܘܗܪܘܬܐ ܕܟܘܟܒܐ ܡܫܚܬܗ (١٠٠) ܓܘܢܐ ܕܡܫܚܬܐ ܕܫܡܫܐ . ܘܫܒܕܘ ܓܠܠܐ (M) ܫܘܦܐ ܕܐܗܐ ܟܘܟܒܐ ܓܘ ܣܘܪܓܐ ܕܗܪܬܙ ܫܦܪܢܓ ܪܣܠ (H-R) .

ܐ . ܠܥܠ ܣܘܪܓܐ ܘܒܝܘܒܗ ܝܡܝܢܐ .

ܒ . ܠܬܚܬ ܕܣܘܪܓܐ ܘܒܝܘܒܗ ܣܡܠܐ .

ܓ . ܡܨܥܬܐ ܕܣܘܪܓܐ .

ܕ . ܠܥܠ ܕܣܘܪܓܐ ܘܒܝܘܒܗ ܣܡܠܐ .

٣ . ܟܠܐ ܗܝܢܐ ܕܟܘܟܒܐ ܝܠܗ ܟܠܐ ܓܠܠܐ ܕܟܘܟܒܐ ܐܝܟ ܕܗܘܐ ܚܕ ܒܥܠܕܐ

ܐ) ١٠ ܚܕܝܘܬܐ ܡܬܘܠܬܢܝܐ   ܒ) ١٠ ܫܢܝ̈ ܢܘܗܪܐ

ܓ) ١٧ ܫܢܝ̈ ܢܘܗܪܐ   ܕ) ١٠ ܦܪܣܟ ܡܬܘܠܬܢܝܐ

٤ . ܟܘܟܒܐ ܟܘܬܠܗ (١٢) ܓܘܢܐ ܒܟܘܬܠܐ ܕܫܡܫܐ . ܘܒܘܪܢܘܬܗ ܕܡܠܐ (٦٠٠٠) ܓܘܢܐ ܠܒܘܪܢܘܬܐ ܕܫܡܫܐ . ܝܠܗ ܟܘܟܒܐ ܡܢ ܟܘܟܒܐ :

ܐ . ܓܒܠܢܐ ܣܡܘܩܐ   ܒ . ܟܘܟܒܐ ܕܢܣܝܒܘܬܐ ܪܒܬܐ

ܓ . ܓܡܕܐ ܚܘܪܐ   ܕ . ܓܡܕܐ ܣܡܘܩܐ

٥ . ܒܪܦܠܐ ܕܫܡܫܐ ܪܒܐ ܕܗܘܐ ܡܢ ܒܪܦܠܐ ܕܫܡܫܐ ܕܠܐ ܡܦܠܛܐ ܢܘܗܪܐ ܡܬܩܪܝܢܐ ܘܝܠܗ ܡܢ ܟܘܟܒܐ ܕܒܪܦܠܐ ܕܫܡܫܐ :

ܐ . ܢܝܘܬܪܘܢ   ܒ . ܢܘܦܐ ܦܘܠܦܐ

ܓ . ܦܘܠܣܪ   ܕ . ܚܠܝܫ ܣܝܡܘܬܐ ܚܕܬܐ

ܬ٢ : ܡܚܘܝ ܫܡܗܐ (ܡܕܝܢܬܐ) ܐܘ (ܩܘܪܝܐ) ܡܢܘ ܟܠ ܦܬܓܡܐ ܡܢ ܦܬܓܡܐ ܕܐܬܝܢ ܠܗ ܡܕܝܢܬܐ ܕܩܘܪܝܐ . ܕܠܐ ܢܫܠܛܘܢ ܕܡܐ ܕܐܬܐ ܡܫܘܚܘ ܫܢܬܐ.

١ . ܡܬܚܙܝܢ ܒܫܘܪܝܐ ܦܬܓܡܐ ܒܒܘܢܐ ܕܫܘܪܝܐ ܘܡܦܪܫܢܘܬܐ ܠܗ ܕܒܬܪ ܚܕܘܬܐ.

٢ . ܟܠܝܗ ܡܕܝܢܬܐ ܓܠܠܐ ܝܠܗ ܡܕܝܢܬܐ ܕܓܘܠܦܐ.

٣ . ܡܠܘܠܘܬܐ ܕܒܪܬܐ ܡܢ ܬܚܘܬ ܕܒܘܟܪܐ ܒܘܪܕܝܐ ܡܠܐ ܡܠܘܠܘܬܐ ܕܒܘܪܐ .

٤ . ܡܘܫܐ ܫܡܘܫܐ ܝܠܗ ܡܢ ܓܘܟܪܐ ܕܢܫܦܘܬܐ ܪܒܬܐ ܘܐܝܬܠܗ ܒܪܢܫܘܬܐ ܘܓܘܡܠܐ ܕܐܘܪܐ.

٥ . ܡܘܕܐ ܪܫܡܐ ܡܠܘܠܘܬܗ ܒܝܕ ܬܘܕܝܬܐ ܝܠܗ ܡܢ ܡܘܕܐ ܡܪܝܐ ܡܢܢ.

ܬ٣ : ܡܢ ܝܠܗ ܟܠܐ ܦܫܛܐ ܘܡܢ ܝܠܗ ܐܫܘܐܝܗ ܒܟܠܐ ܐܠܦܐ.

ܬ٤ : ܡܢ ܝܠܗ ܝܠܕܐ ܕܒܪܢܫܘܬܐ ܝܠܕܐ ܕܓܘܟܪܐ ܫܡܠܝܐ ܫܡܘܫܐ.

ܬ٥ : ܐܡܢ ܒܝܕ ܝܕܝܥܐ ܒܟܘܡܪܐ ܓܘܟܪܐ ܡܢ ܒܘܪܠܐ ܐܚܪܢܐ ܐܘ ܓܘܟܪܐ ܡܢ ܒܘܪܠܐ ܕܐܘܪܐ ؟ ܘܐܡܢ ؟

ܬ٦ : ܪܒܘܬ ܠܐܫܘܐܝܐ ܒܝܢ ܒܘܪܠܐ ܕܓܘܟܪܐ ܥܡ ܒܪܢܫܘܬܗ. ܘܐܪܐ ܒܠܥܕ ܠܐ ܟܠܝܗ ܓܘܟܪܐ ؟

ܬ٧ : ܐܡܢ ܦܬܐ ܫܒܥܬܐ ܒܡܪܐ ܒܡܠܟ ܒܘܟܪܐ ܒܠܐ

ܬ٨ : ܦܝܫ ܒܝܢ ܓܘܟܪܐ ܫܡܠܝܐ ܫܡܘܫܐ ܘܓܘܟܪܐ ܡܘܫܐ ܫܘܪܐ.

ܫ٩ : ܠܡܢܐ ܩܪܝ ܠܟܘܟܒܐ ܟܘܡܐ ܫܒܝܠܐ ܟܘܡܐ

ܫ١٠ : ܡܒܝܢ ܠܟܪܘܦܠܐ ܕܡܫܚܐ ܘܡܢܝܢ ܠܐܪܒܥܗ .

ܫ١١ : ܡܢܐ ܝܠܗ ܗܘܡܐ ܕܫܘܪܐ؟ ܘܕܐܝܡܐ ܗܘܡܐ ܢܦܠܐ ܒܡܢܐ؟ ܥܡ ܕܪܫܡܬܐ
ܕܐܗܒܝܡܐ ܕܫܘܪܐ.

ܫ١٢ : ܕܪܫܘܡ ܨܘܪܐ ܕܟܘܟܒܐ ܩܕܡܝܐ (Proto star) .

هەرێمی کوردستانی عێراق
وەزارەتی پەروەردە

ܡܠܟܘ… ܪܕܣܬܢ ـ ܥܝܪܩ
…ܪܒܝܬܐ

ܩܪܝܢܐ

ܣܦܪܐ ܚܡܫܝܐ ܡܘܠܦܢܐ

ܬܪܓܡܬܐ ܒܝܕ :

ܐܒܪܗܡ ܢܘܚ ܓܘܪܓܝܣ

ܛܒܥܬܐ ܩܕܡܝܬܐ
6752 ܐ ـ 2002 ܡ

ܡܛܒܥܬܐ ܕܘܙܝܪܘܬܐ ܕܬܪܒܝܬܐ ـ ܐܪܒܝܠ

ܡܠܟܐ ܕܟܘܪܕܣܬܢ . ܥܝܪܩ

ܘܙܝܪܘܬ ܡܪܕܘܬܐ

هەرێمی کوردستانی عێراق

وەزارەتی پەروەردە

ܦܝܣܝܟܐ

ܣܦܪܐ ܫܒܝܥܝܐ ܡܘܠܦܢܐ

